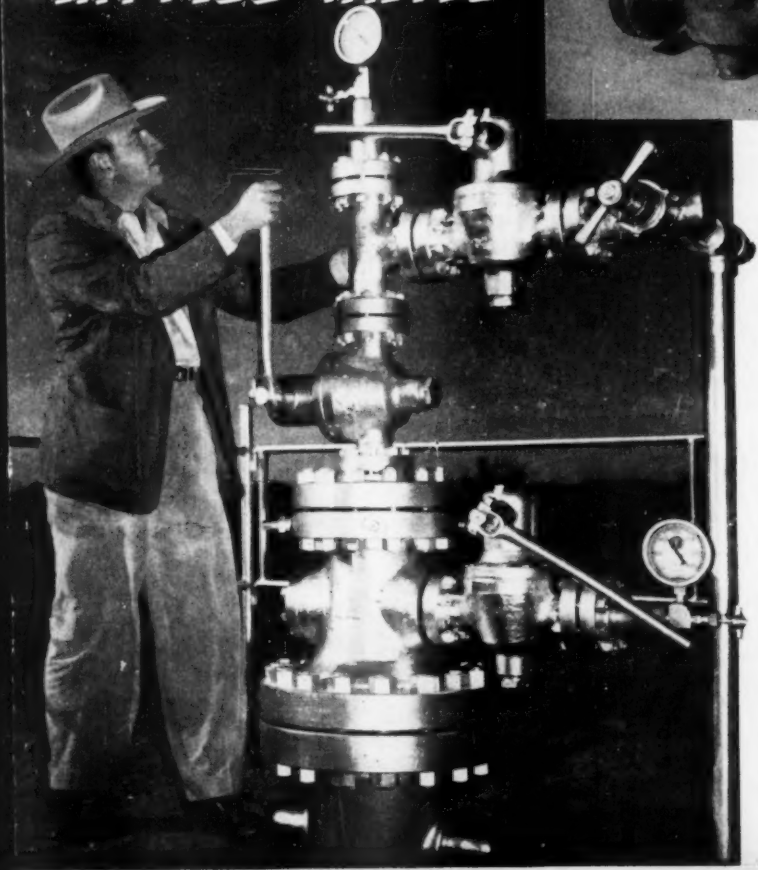
the OIL AND GAS JOURNAL

Cameron

NON-LUBRICATED

LIFT-PLUG VALVES



Basically Better

7 WAYS

ONE — NON-LUBRICATED — no grease required to effect seal; prevents contamination and clogging of meters; reduces chance for human error and need for maintenance.

TWO—PRESSURE SEALING—when plug is seated, line pressure automatically forces seat into tighter engagement with plug—body distortions do not affect seal.

THREE—UNIQUE LIFT-PLUG ACTUATOR—A novel design which lifts, turns and reseats plug in continuous turn of a lever.

FOUR—RENEWABLE SEAT AND PLUG—easily replaced; permits any desired trim for specific services.

FIVE—REPAIRS ON THE JOB—can be completely overhauled without removal from line; no special tools or skill required.

SIX—EASY OPERATION—requires less operating effort than other valve designs.

SEVEN—FORGED STEEL—all parts, including body for many sizes, are press or drop forged from specification materials.

CAMERON IRON WORKS, INC.
P. O. Box 1212 Houston, Texas
Export: 74 Trinity Place, New York

PRICE 50 CENTS TABLE OF CONTENTS PAGE 33 **DECEMBER 27, 1951**

ROCKWELL ORIFICE METERS

Take high pressures in stride

WITH NEW LEAKPROOF STUFFING BOX

When the pressure is *up*, it will pay you to use Rockwell orifice meters. They have the exclusive advantage of a revolutionary new stuffing box that prevents leakage troubles at this vulnerable point. The unit is self-lubricated, requires no maintenance. The higher the pressure, the tighter it seals—yet the shaft will freely rotate even under extreme conditions.

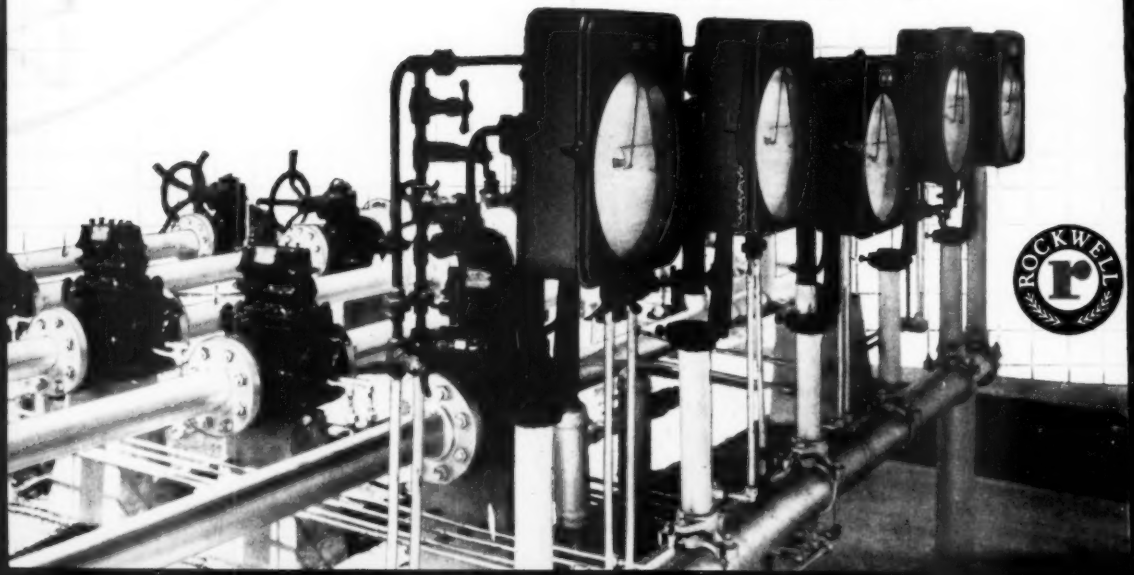
You'll get this new leakproof stuffing box *plus* forged steel chambers, unit manometer construction, positive inking pens and a host of other features in Rockwell orifice meters. For either high, low or intermediate pressures they are your best buy. Write for bulletin 1050.

Stuffing Box Details

This unit has a *combination packing and bearing* made of Teflon. The material is tough, chemically resistant, stands up to 400° F. and has a low coefficient of friction. Teflon flows slightly under pressure to adjust itself to the stuffing box body and the periphery of the shaft. It seals without binding! The spring loaded follower serves as a pilot to hold the Teflon in alignment. All other parts are stainless steel. Packaged stuffing box kits for converting meters in service are available.

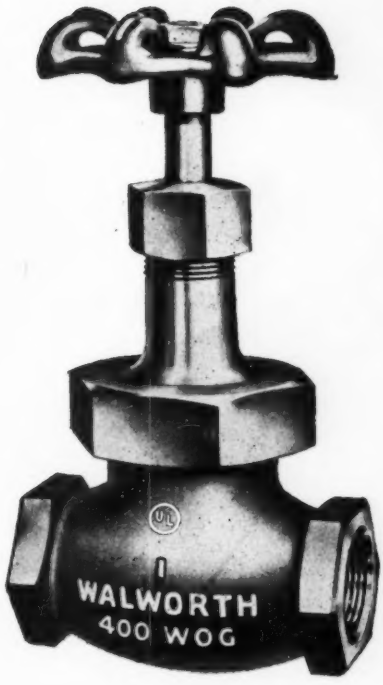
ROCKWELL MANUFACTURING COMPANY
Pittsburgh 8, Pa.

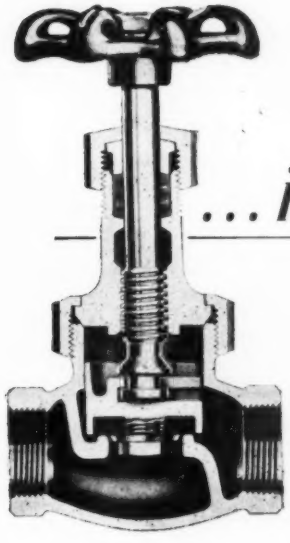
Atlanta • Boston • Chicago • Columbus • Houston
Kansas City • Los Angeles • New York • Pittsburgh
San Francisco • Seattle • Tulsa



Built for LP-Gas Service

Approved by Underwriter's Laboratories





... inside and out!

Walworth's No. 91 Bronze Globe and No. 92 Bronze Angle Valves are designed especially for liquefied petroleum gas service.

These valves have rising stems and union bonnets. The stuffing box has a gland and is packed with a special material suitable for LP-Gas service, which gives a free-turning valve stem without leakage. The valve can be repacked under pressure when fully opened.

The discs are made of a synthetic rubber-like material unaffected by liquefied petroleum. These discs are cemented to the holders and further secured by the usual disc nut. Disc holders can be removed and new ones inserted easily and quickly. If the valve is fully opened before the bonnet is removed, the disc holder cannot fall from the stem. The disc holder's special construction keeps the disc accurately guided under all installation positions.

These quality valves are rated and marked 400 pounds WOG. *They are approved by the Underwriter's Laboratories for Liquefied Petroleum Gas Systems*, and meet all safety regulations now prevailing in the industry, such as those published in pamphlet No. 58 of the National Board of Fire Underwriters.

For further information on these long-life, economical Walworth Bronze Valves see your nearby Walworth distributor, or write for Circular No. 100.

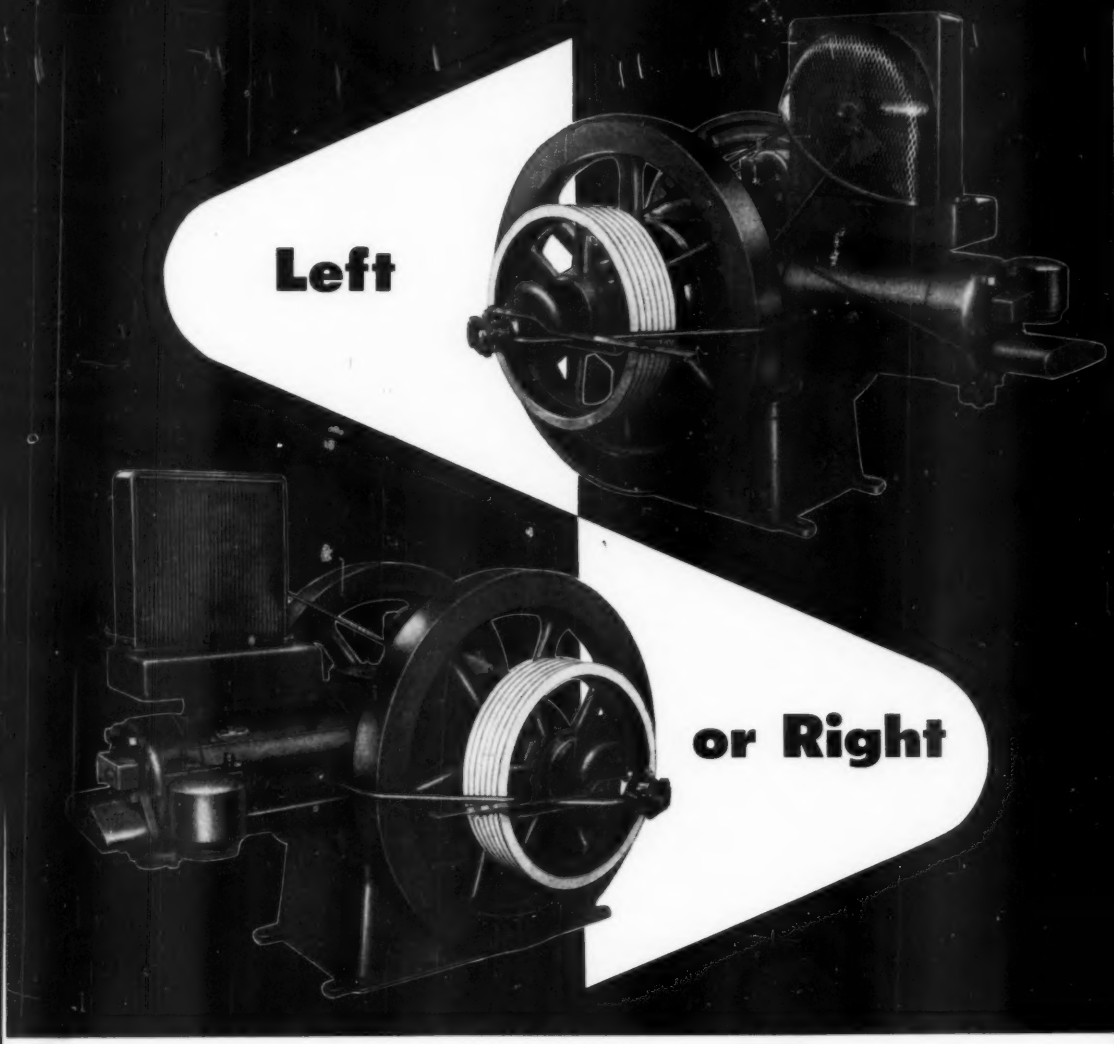
WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

The Oil and Gas Journal, published Thursdays by The Petroleum Publishing Company. Entered as second-class matter September 1, 1910 at post office at Tulsa, Okla., under act of March 3, 1879. U. S. and foreign rates to the petroleum industry, $3 yearly. Copyright 1951



is right with the "ZC"

With a Fairbanks-Morse "ZC" Engine on your pumping rig, you can mount your clutch and sheave on either the *right* or *left* side of the engine. It's a big convenience feature that makes it easy for you to mount the engine where you want it on your pumping jack.

The TWO big flywheels of the "ZC" make this feature possible and give you the important flywheel effect on each side of the engine for smooth operation and economical performance.

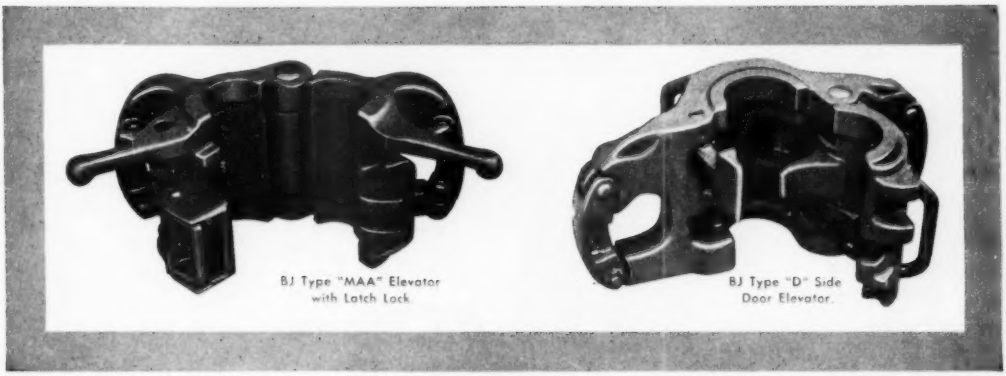
The Fairbanks-Morse Type "J" clutch and sheave assembly are ruggedly built units with extra heavy friction plates and contact parts to prevent distortion and assure uniform pressure at all times.

For the complete story on the *"ZC" . . . the engine with the big double wheels*, see your local supply store or write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

FAIRBANKS-MORSE,
a name worth remembering

OIL FIELD EQUIPMENT • PUMPS • SCALES • ELECTRIC MOTORS • GENERATORS • LIGHT PLANTS • DIESEL, DUAL FUEL AND GASOLINE ENGINES • MAGNETOS • DIESEL LOCOMOTIVES

BJ *ENGINEERED*
OIL TOOL REBUILDING
makes old elevators good as ***new!***



BJ Type "MAA" Elevator with Latch Lock

BJ Type "D" Side Door Elevator.

Modern, high speed drilling operations subject an elevator to terrific shock and wear. Here's how BJ's factory rebuilding service repairs worn elevators.

1. Magnaflux inspection finds cracks the eye does not detect.

2. Worn surfaces are rebuilt with carefully selected welding rods.

3. Controlled reheat treatment restores steel to its original physical properties.

4. Precision machining is assured by means of the correct fixtures as used in the original production of BJ elevators. This procedure provides perfect fits and new efficiency.

5. All tool joint lifting surfaces are flame-hardened for maximum life.

6. And the final magnaflux inspection assures you of the care and supervision that goes into the repair of BJ elevators.

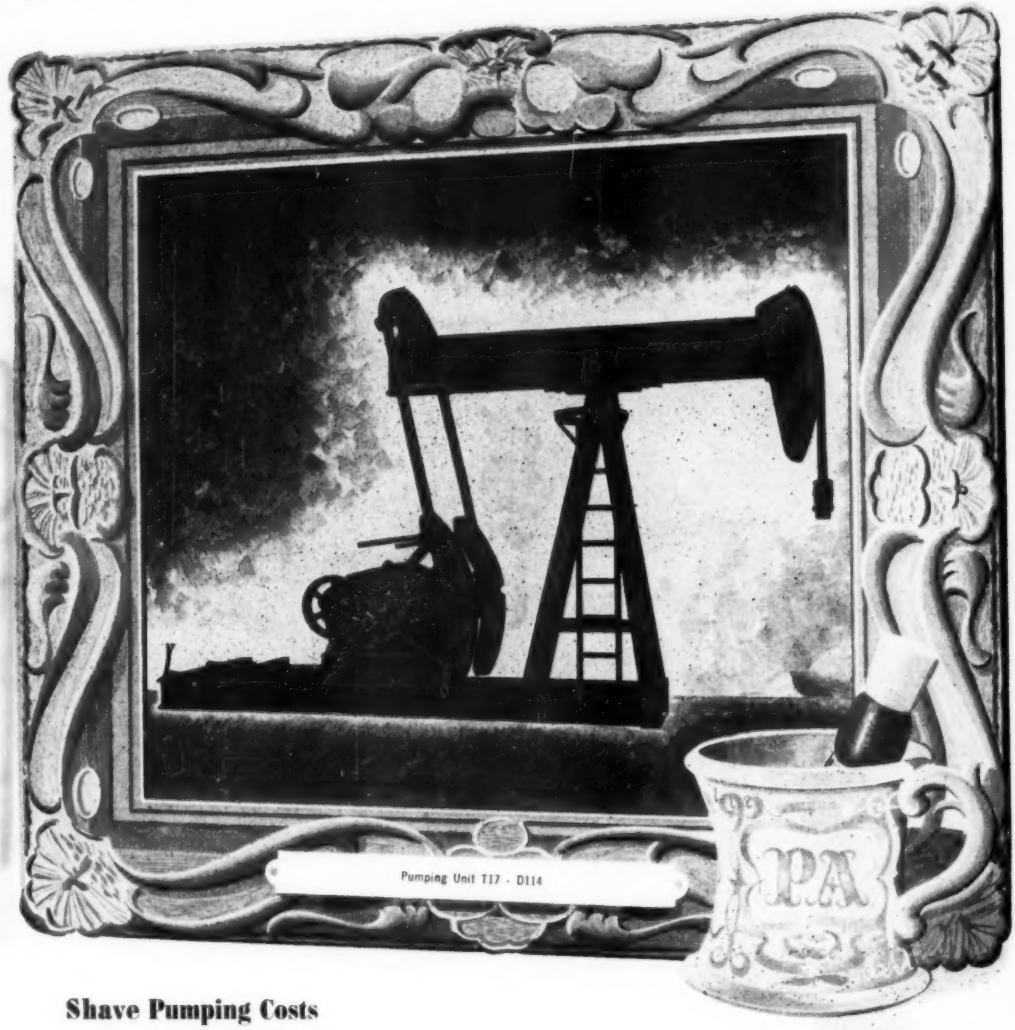
The men and machines that made 'em know 'em best!

ASK YOUR BJ REPRESENTATIVE OR JOBBER...

BJ
FACTORY SERVICE
Engineered
OIL TOOL REBUILDING
for safety and long life

Byron Jackson Co.

Great AMERICANS



Shave Pumping Costs

with AMERICAN Pumping Units

Available in a complete range of sizes to meet every pumping requirement economically. Write for Catalog 151. Contact your favorite supply store or the nearest American office.

AMERICAN MANUFACTURING COMPANY OF TEXAS

Branch offices:
Houston, Texas, 320 West Bldg., Ph. Ch. 4-3301
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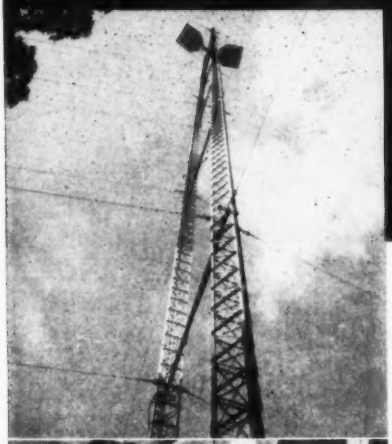
New York, N. Y., 500 Fifth Ave., Ph. LA. 4-1857

FORT WORTH 1, TEXAS PHONE VALLEY 2301

21—Motorola microwave systems are in and working!



Partial List of Microwave Systems

- Aeronautical Radio Incorporated
- State of California
- Pan American Pipeline Co.
- Shell Pipeline
- Panhandle Eastern Pipeline Co.
- Texas Illinois Natural Gas Pipeline Co.
- Mid-Valley Pipeline Co.
- Brazos River Electric Transmission Cooperative
- City of Dayton, Ohio
- Michigan State Police

Including the world's first 1000-mile private operating system

Here is Experience that you can rely on!

Facing a healthy new demand for more serviceable and flexible communication facilities, responsible management turns to Microwave for the extension of communication facilities.

Use the Motorola Microwave circuit for telephone, teletype, telemetering, remote switching and general supervisory control applications.

Motorola is experienced in shaping the systems-design to meet the customers day-in-day-out operational problems.

More than 20,000 installations in the past ten years have proved the reliability of Motorola 2-way radio—and now more than 25,000 miles of Motorola Microwave operating circuits have proved the unquestioned reliability of Motorola Microwave Communications.

Make your new plant truly *new* all the way with Motorola Microwave.

Write for free booklet "The Motorola Microwave Story" and incidentally a Motorola engineer is ready to assist you with generous and thoroughly competent information.

Motorola

Communications and Electronics Division
4545 Augusta Blvd., Chicago 51, Illinois

The Specialists in industrial radio communication systems

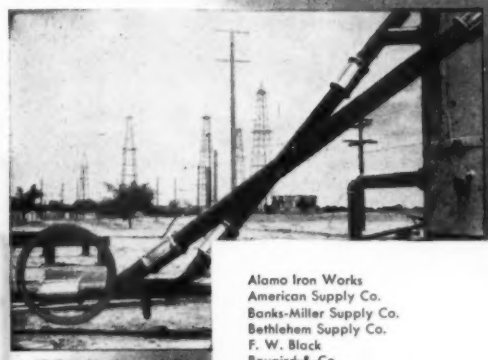
22 Years of Leadership in Mobile Radio

World's leading producers (twice as many as all others *combined*) of 2-way mobile radio. Microwave, carrier and control systems and general radio communication equipments.

Remember! *Experience Counts*
Especially in Microwave

DRESSERS...QUICK and HANDY

...at your favorite supply store



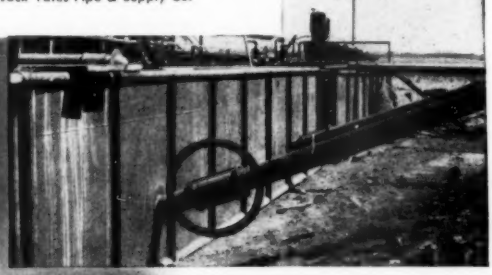
Well and tank connections made easy with Dresser Style 40 Long Sleeves. They're tight and flexible, even where pipe-ends don't meet.

Gathering lines are laid quickly with Dressers, day or night regardless of weather. When coupled with Dressers, lines can be easily relocated when necessary.

Alamo Iron Works
American Supply Co.
Banks-Miller Supply Co.
Bethlehem Supply Co.
F. W. Black
Bovaird-&-Co.
Bovaird & Seyfang Mfg. Co.
The Bovaird Supply Co.
Bradford Supply Co.
Briggs-Weaver Machinery Co.
Brown-Strauss Corp.
The Cameron & Barkley Co.
Capital City Supply Co.
Cen-Tex Supply Co.
Clowe & Cowan, Inc.
Coastal Supply Co.
Continental Supply Co.
Cooper Supply Co.
C. W. Cotton Supply Co.
Crane Co.
Dunigan Tool & Supply Co., Inc.
Federal Oil Field Supply Co.
Franklin Supply Co.
Frick & Lindsay Company
General Oil Field Supply Co., Inc.
Grinnell Co.
Houston Oil Field Material Co., Inc.
Howard Supply Co.
Industrial Supply Co.
International Derrick & Equipment Co.
Iverson Supply Co.
Jarecki Manufacturing Co.
Jones & Laughlin Supply Co.
Keystone Pipe & Supply Co.
Lloyd-Smith Co.
Louden Tool Co.
Louisiana Supply Co.
The McJunkin Supply Co., Inc.
Mid-Continent Supply Co.
Midland Supply Co., Inc.
Momsen, Dunnegan & Ryan
Morrison Supply Co.
Mountain Iron & Supply Co.
Murray-Brooks Hardware Co., Ltd.
The National Supply Co.
Norvell-Wilder Supply Co.
Oil Well Supply Co.
Peden Iron & Steel Co.
The Peerless Supply Co., Inc.
Pelican Well Tool & Supply Co.
Producers Supply & Tool Co.
Republic Supply Co.
Republic Supply Co. of California
San Antonio Machine & Supply Co.
Spain Supply Co.
Standard Supply & Hardware Co., Inc.
Superior Iron Works & Supply Co., Inc.
United Supply & Mfg. Co.
Weaks Supply Co., Ltd.
Well Machinery & Supply Co., Inc.
Western Supply Co.
Wilson Supply Co.
Jack Yates Pipe & Supply Co.

Dresser Style 40 Long Sleeves spans the gap and gives a tight, vibration-proof joint on the "Christmas Tree" below. Factory-built Dressers are ideal for jobs like this . . . and available overnight.

"40" Dresser Long Sleeves on rotary drilling rig mend lines. Pipes are joined easily with Dressers, using only a wrench. Vibration stresses are absorbed. Lines stay flexible-tight.



DRESSER COUPLINGS and Repair Products

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide St., W., Toronto.

Make one call do it all!

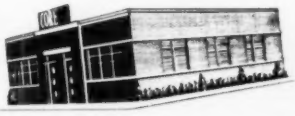
ON-LOCATION CORE ANALYSIS

STATION WAGON CORE ANALYSIS

SUITCASE CORE ANALYSIS

FROZEN CORES

SIDE WALL CORE ANALYSIS



OFF-LOCATION CORE ANALYSIS

WELL LOGGING (on-shore)

WELL LOGGING (off-shore)

WELL SAMPLING

RESERVOIR FLUID ANALYSIS

ENGINEERING STUDIES

DIAMOND CORING RENTAL SERVICE

CORE LABORATORIES, INC. ● **IN ALL ACTIVE AREAS**

Dallas, Houston, Corpus Christi, Midland, Abilene, San Antonio, Tyler, Wichita Falls, Lubbock, and Post, Texas; Oklahoma City, Oklahoma; Great Bend, Kansas; Shreveport, Lafayette and New Orleans, Louisiana; Natchez, Mississippi; Bakersfield, California; Denver, Colorado; Worland, Wyoming; El Dorado, Arkansas; Farmington, New Mexico; Calgary and Edmonton, Canada; Venezuela, S. A.

CORE LAB

PETROLEUM RESERVOIR ENGINEERING

Minimize maintenance costs on refinery jobs by using CP reversible AIR IMPACT WRENCHES — powerful, compact, perfectly balanced, no twisting thrust to fatigue operator.

There's a range from $\frac{1}{4}$" to $1\frac{3}{4}$" bolt size, with angle head models for hard-to-reach nuts, bolts and studs.

Capacities — Bolt Size		
CP-337	$\frac{1}{4}$"	
CP-344	$\frac{3}{8}$"	
CP-3440	$\frac{3}{8}$"	heavy duty
CP-349	$\frac{5}{8}$"	
CP-360	$\frac{3}{4}$"	
CP-3630	$\frac{3}{4}$"	heavy duty
CP-365	$1\frac{1}{4}$"	
CP-375	$1\frac{3}{4}$"	

Write for a copy of Bulletin 812

CHICAGO PNEUMATIC TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

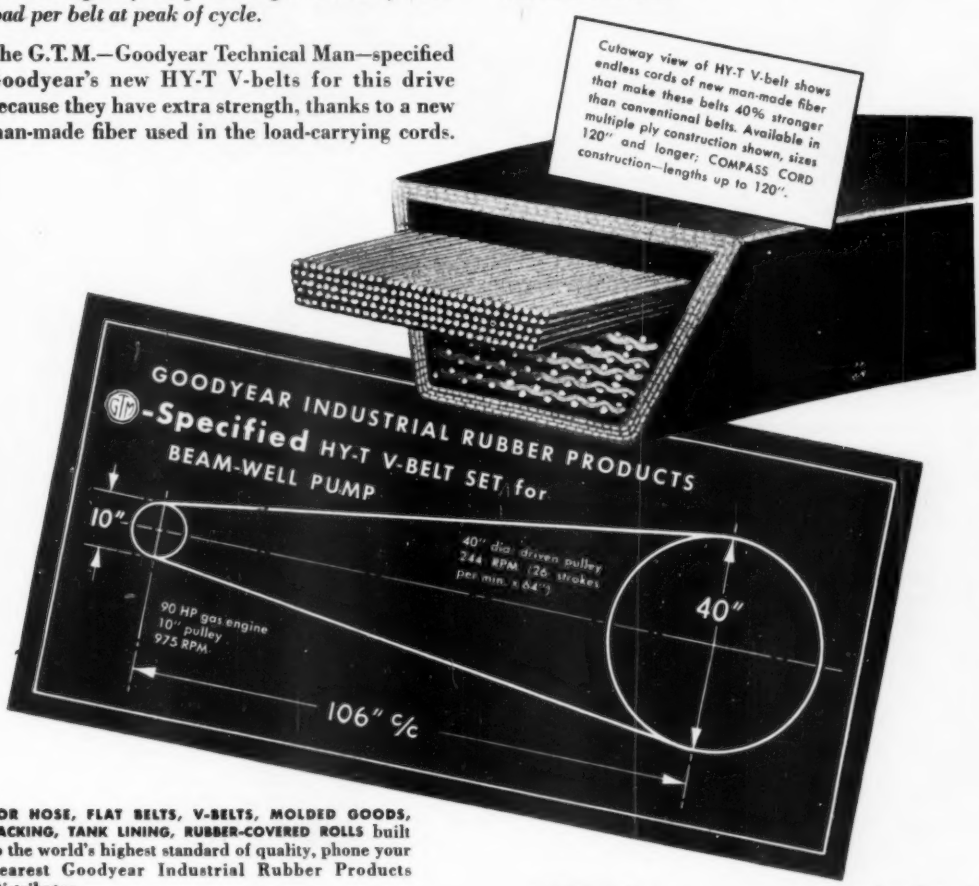
4 times average service

and double the best previous record!

SETS of ordinary V-belts on beam-well pump averaged 7½ months' service; the best used previously failed in 1 year. Reason was high torque developed by 26 stroke-per-minute x 64″ stroke length cycle, producing *100 lbs. of overload per belt at peak of cycle.*

The G.T.M.—Goodyear Technical Man—specified Goodyear's new HY-T V-belts for this drive because they have extra strength, thanks to a new man-made fiber used in the load-carrying cords.

HY-T belts have now been operating this pump 24 hours a day for 2½ years—and are still in good condition. If you have a troublesome V-belt drive, and if you want better than average V-belt service, call in the G.T.M.


Cutaway view of HY-T V-belt shows endless cords of new man-made fiber that make these belts 40% stronger than conventional belts. Available in multiple ply construction shown, sizes 120″ and longer; COMPASS CORD construction—lengths up to 120″.
GOODYEAR INDUSTRIAL RUBBER PRODUCTS
GTM-Specified HY-T V-BELT SET for BEAM-WELL PUMP
10″
40″ dia. driven pulley 244 RPM (26 strokes per min. x 64″)
40″
90 HP gas engine 10″ pulley 975 RPM
106″ c/c

FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

HY-T, Compass—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

THE GREATEST NAME IN RUBBER

Economical Pumping Starts with the Right Rod...

There's only one way to be really sure of economical pumping and minimum down-time—that's to use a rod which is specially designed for service in a particular type of well.

Bethlehem Sucker Rods are economical and thoroughly dependable because they are well made from quality steel. The Bethlehem X, XX, and X2 Rods are fully normalized. The Bethlehem "46" Rod is fully normalized and fully tempered. In the normalizing operation, a special device for rapidly transferring each rod from the furnace to the cooling bed insures a completely normalized rod.

Depending upon type, Bethlehem Sucker Rods can be used successfully in conditions varying from medium-pumping duty in non-corrosive wells to heavy-pumping duty in corrosive wells.

What's more, Bethlehem Sucker Rods come in a special unit package. The spacers used in this package protect the rods during shipment—keep them from taking a definite set. Because the rods reach you in good condition, there's no lost time in handling at the yard.

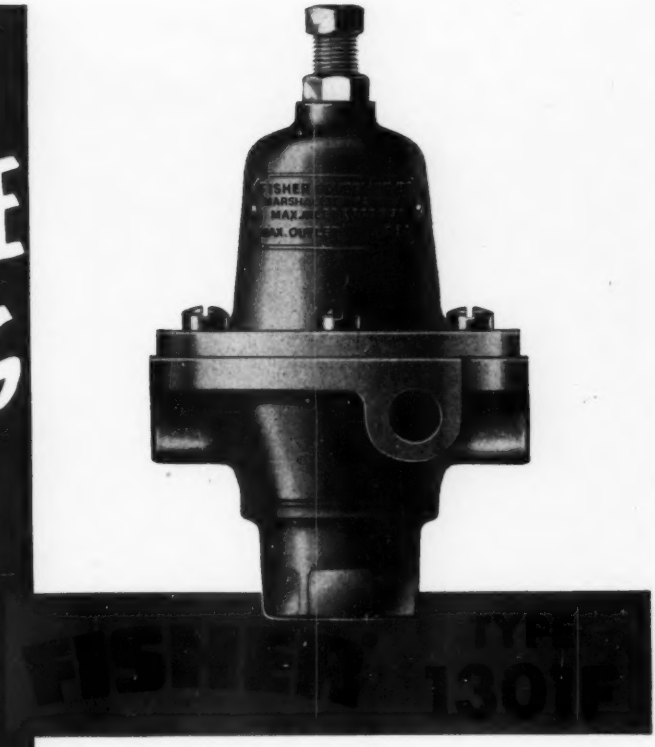
If you would like complete information about Bethlehem Sucker Rods and accessories, please get in touch with the nearest Bethlehem sales office or sucker rod distributor. Or drop a line to us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

BETHLEHEM *Sucker Rods*

BETHLEHEM STEEL

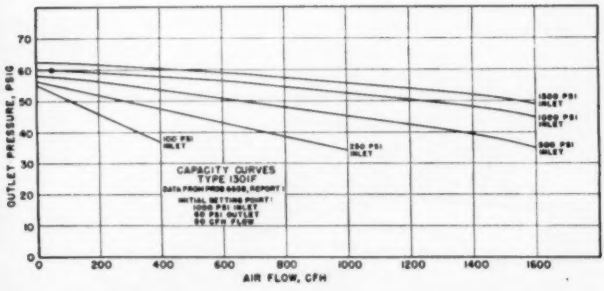
HIGH PRESSURE REDUCING VALVE for AIR or GAS SERVICE



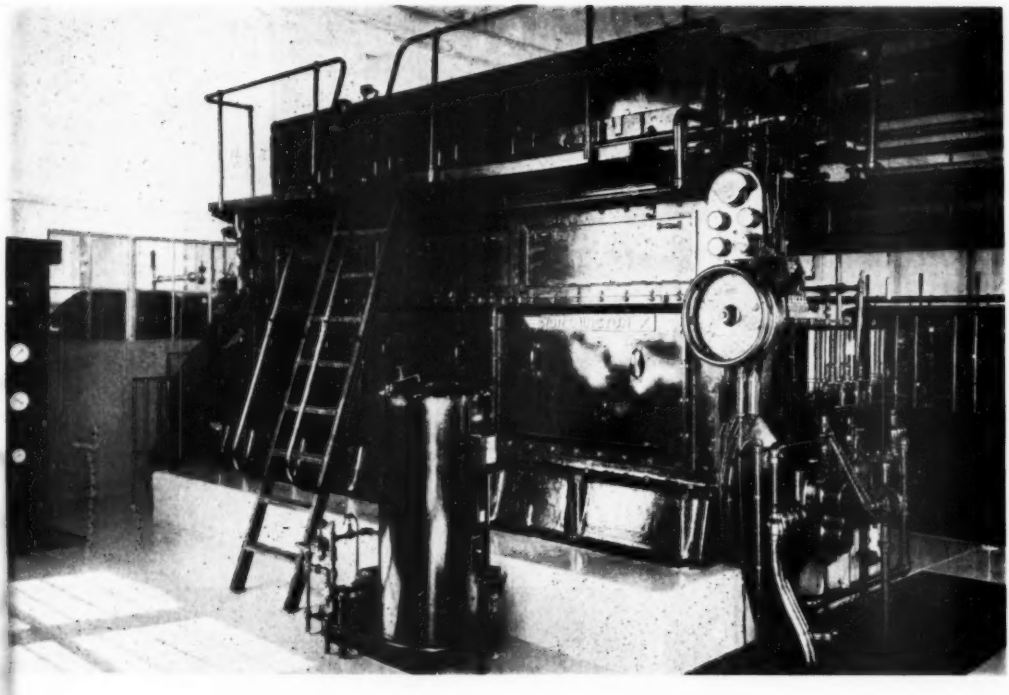
Type 1301F is commonly used in conjunction with pilot operated controllers where high pressure operating medium is used. They are also used in general industrial applications for high pressure reduction of non-corrosive air or gas.

CONSTRUCTION:
All forged bronze construction with glass impregnated Teflon valve disc, stainless steel orifice. Furnished with one inlet connection and two outlet connections of ¼" pipe size.

PRESSURE RANGE:
Suitable for inlet pressures up to 3000 PSI; reduced pressure spring ranges of 10 to 75 PSI; 50 to 150 PSI. Adjustment screw for easy adjustment of reduced pressure setting.



FISHER GOVERNOR COMPANY
Marshalltown, Iowa



No Standby Needed

Worthington Reliability Saves Thousands of Dollars in Investment Cost

Here's one of twelve Worthington Diesel engines used exclusively on a large oil pipe line running across Texas.

They power the pumps which maintain a constant flow of crude oil from field to refinery.

In none of the pumping stations is there a standby engine. The pipeline company is confident that its Worthington Diesels will *stay on the job.*

Portable pumping units are connected into the line during routine maintenance checks.

Engine fuel is raw crude bled from the line. This is a severe application. But Worthington—one of the first to utilize crude for Diesels—knows how to lick the problem.

For any engine application, call on Worthington—an engine for any fuel: oil (crude or regular), gas or "dual fuel". Worthington's complete line of engines assures you of the most economical operation no matter what fuel you use.

For further information, write Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.

WORTHINGTON

ENGINES

E.1.5

ECONOMICAL CONTINUOUS POWER

Diesel Engines, 150 to 2640 hp
Gas Engines, 190 to 2880 hp
Dual Fuel Engines, 345 to 2640 hp

WORTHINGTON-BUILT AUXILIARIES

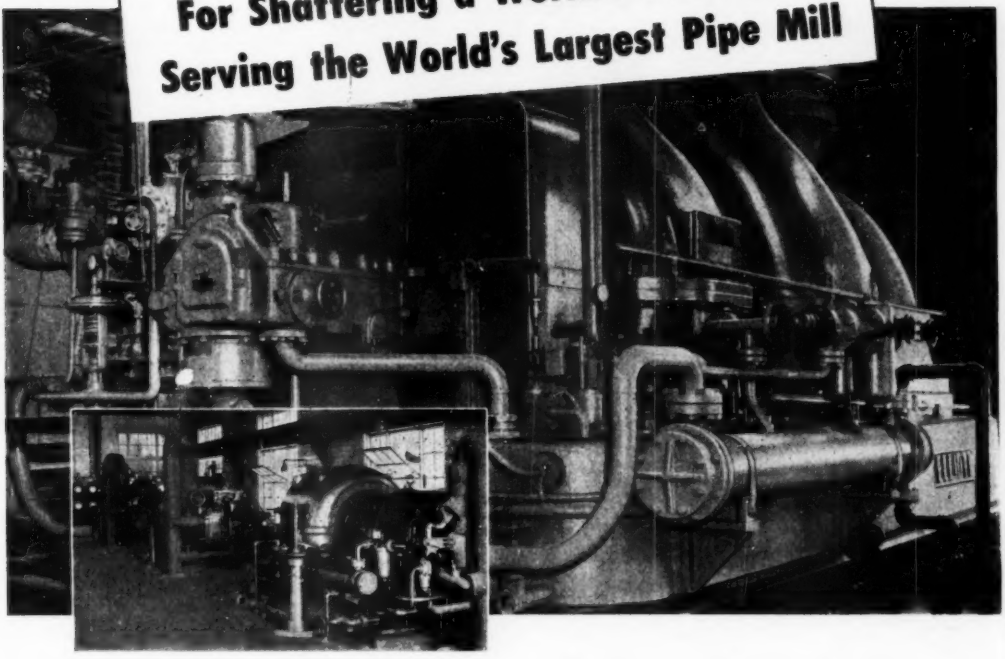
Engine Starting Compressors

Oil Transfer Pumps

Cooling Water Circulating Pumps

Evaporative Type Engine Water Coolers

For Shattering a World's Record or Serving the World's Largest Pipe Mill



...Elliott turbine-driven blowers depend on Ross Exchangers for lube oil temperature safety

In fluid cat cracker service at a mid-western refinery, a 3500 hp Elliott multi-valve condensing steam turbine driving an Elliott multi-stage blower, with a capacity of 50,000 cfm of free air, has shattered a world's record by piling up 677 days of continuous operation. A Ross Exchanger has the job of protecting the lubricating oil temperature.

At the world's largest pipe mill in Ohio, four 600 hp Elliott multi-stage steam turbines (inset photo) are driving four Elliott multi-stage blowers rated at 29,750 cfm each. These, also, have the protection of Ross Exchangers.

Just as Ross Exchangers are doing a job for Elliott in these and other important instances, so can they become key accessories on *your* turbines, compressors, engines and hydraulic machines . . . no matter what field they're serving.

You'll find more Ross Exchangers as built-in components than any other make. Ross standardization has accomplished this.

Literature describing these units will be mailed promptly at your request. ROSS HEATER & MFG. CO., INC., Division of American Radiator & Standard Sanitary Corp., 1417 West Avenue, Buffalo 13, N. Y. In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · ACME CABINETS · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

Whether you want one worm-gear speed reducer or a thousand, a standard drive or a unit designed to meet special problems, Cleveland can serve you better.

"Cleveland" is the standard in worm gearing

● When you specify "Clevelands—or equal," you can be confident that you are getting the finest in worm-gearing.

The uniform dependability that has distinguished Clevelands through 38 years has established "Cleveland quality" as the measure of value in worms and gears. Cleveland sets the pattern through four outstanding features:

1. *Correctness of design*—proved by years of performance.
2. *Finest of materials*—selected on the basis of long experience and research.
3. *Modern manufacturing facilities*—kept up-to-date by a policy of continuous replacement.
4. *Precision workmanship*—by machinists and other production workers, trained as craftsmen.

Cleveland offers a complete line of worm gear sets and speed reducers, including the popular fan-cooled Speedaire —to meet the needs of any machinery or equipment builder or user. Representatives in all major industrial centers are at your service. Write for our current catalog.

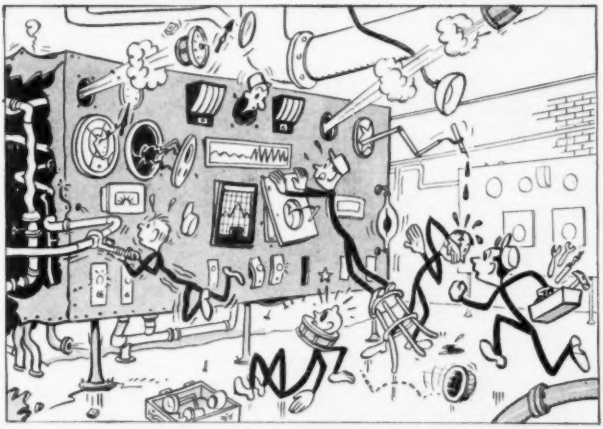
The Cleveland Worm & Gear Company, 3286 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

Bouncing Pipes give a Plant the Jitters

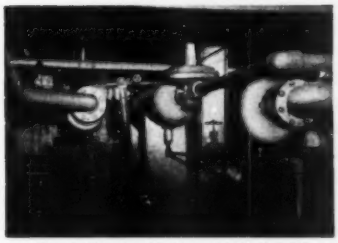
★ FOR SURGE CONTROL IN GAS AND AIR LINES CONSULT BURGESS-MANNING ENGINEERS

Pipes that bounce and vibrate are a nuisance . . . and a plant with the jitters is not operating at top efficiency. To help you solve this problem, Burgess-Manning has developed a Gas and Air Line Snubber which effectively reduces surging . . . practically eliminating the resultant vibration of gas and air lines excited by compressors, blowers, or reciprocating pumps. To aid you in maintaining the operation of your plant at rated capacity, consult Burgess-Manning.

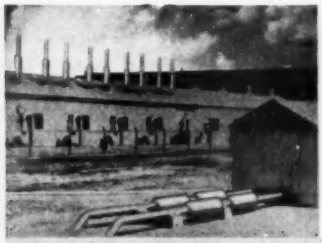


BURGESS-MANNING COMPANY

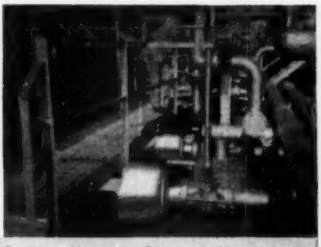
749 East Park Avenue, Libertyville, Illinois
1203 Dragon Street, Dallas, Texas



Gas and Air Line Snubbers installed on the first stage and the high stage of an Ingersoll-Rand Compressor.



Four Burgess-Manning Gas and Air Line Snubbers installed ahead of two meter runs at a Wyoming recycling plant.

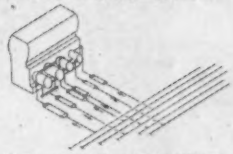


Burgess-Manning Gas and Air Line Snubbers installed on the discharge side of a compressor at a natural gasoline plant.

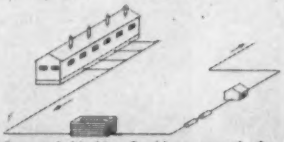
Bulletin 92, "Surge Control."

Booklet, "Bouncing Pipes."

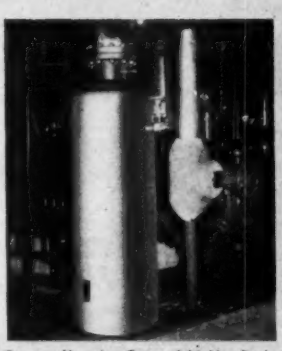
The function of the Burgess-Manning Gas and Air Line Snubber is to prevent the rapid pressure change, which occurs at the compressor or blower, from being transmitted to the pipe line.



Snubbers reduce vibration in all lines due to the intermittent suction or discharge of compressors and blowers.



Gas and Air Line Snubbers smooth the flow of gas without constriction and stop vibration without mechanical damping. Metering fluid flow is greatly simplified.



Burgess-Manning Gas and Air Line Snubber installed on discharge side of a compressor at an Oklahoma refinery.

RANGE OF OPERATIONS Burgess-Manning Gas and Air Line Snubbers, custom designed and fabricated around a wide variety of standard parts, are specifically engineered to meet any or all of the following design requirements: all pressures—up to 5,000 psi • all gases and mixtures of gases. These include, among others, hydrogen, butadiene, ammonia, propane, and freon • all weights of gases—molecular weight as low as 7 to as high as 120 • all pipe sizes—as large as 24" diameter pipes • Gas and Air Line Snubbers are designed to meet ASA, ASME, and API-ASME Construction Code requirements. Snubbers can be constructed to conform to the code requirements of any state.

for dependable performance at any depth use an IDEAL swivel

Under any and all conditions of drilling there's an IDEAL Swivel that's sure to do a real job day-after-day. When you buy an IDEAL Swivel for any specific need you're actually buying two things—dependable performance based on National Supply's long experience with oil-field equipment, and dependable service for your IDEAL Swivel through the National Supply Store.

Whatever your drilling requirements—shallow, medium, deep or deepest, there is an IDEAL Rotary Swivel designed to match these requirements and give trouble-free operation. And at the National Supply Store you'll find a full stock of packings, bearings, replacement parts to insure that your investment in an IDEAL Swivel will pay off in long service-life.

Write for bulletins about IDEAL Swivels, or check with your National Supply Representative.

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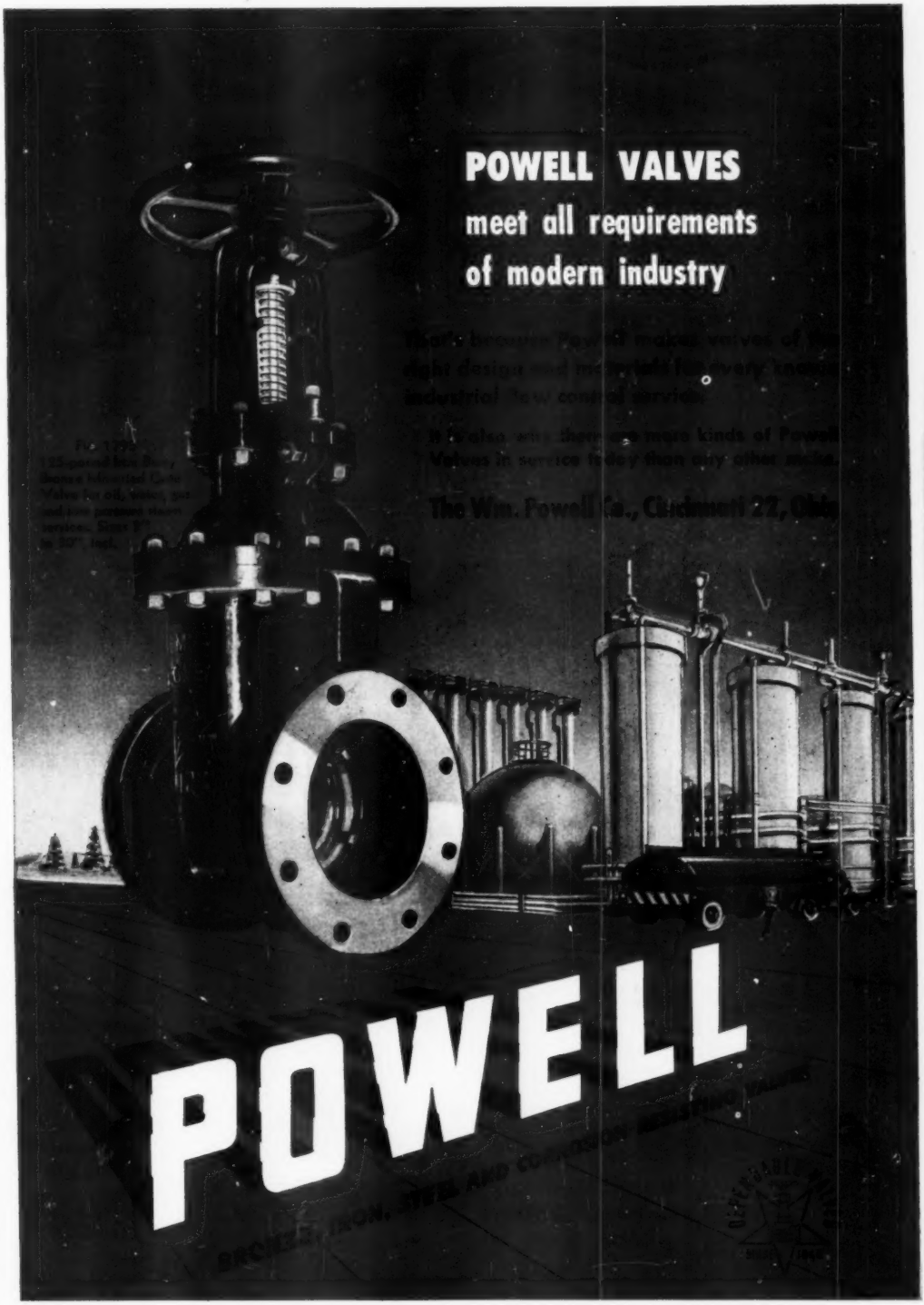
NATIONAL OIL FIELD MACHINERY & EQUIPMENT • SPANG STEEL PIPE • SUPERIOR & ATLAS ENGINES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meet all requirements
of modern industry
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Six more excellent reasons for getting better acquainted with ONE-STOP service at your near-by Jones & Laughlin Supply store.

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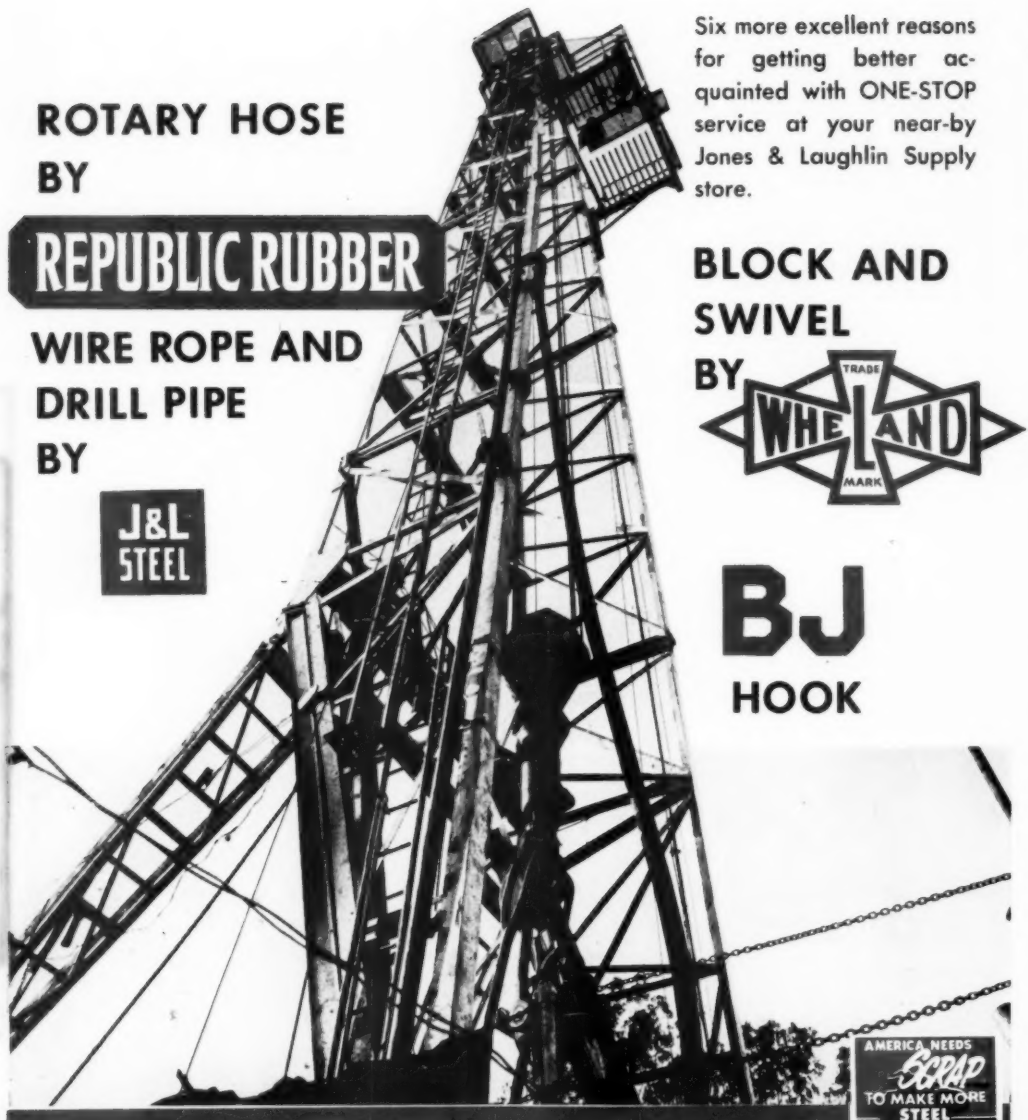

AMERICA NEEDS SCRAP TO MAKE MORE STEEL
YOU CAN HELP

Jones & Laughlin Supply Company

"... here's MY warehouse!"

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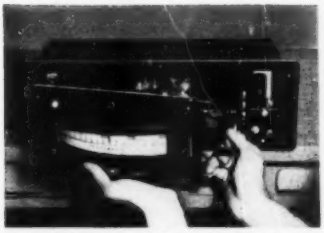


G-E Pyrometer Equipment Quick and Easy to Inspect, Maintain

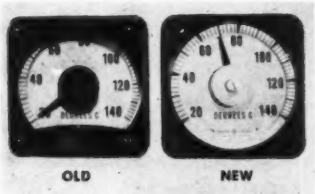
Routine inspections of new General Electric Type HP pyrometers can quickly be made. Besides making preventative maintenance easy, this equipment has many other features to provide accurate indication and temperature control of furnaces, ovens kilns, and other industrial heating equipment.

ACCURATE WITHIN $\frac{3}{4}$ **OF 1%** full scale, HP-3 pyrometers have automatic cold-junction compensation that adjusts for changes in ambient temperature.

Any change in temperature, even as small as 0.1% full scale, starts immediate control action. Normal changes in humidity, ambient, and voltage have little or no effect on the exactness of control action.

FOUR TYPES AVAILABLE—indicating, protecting, two- and three-position control forms; also both flush and surface mountings. All available in a variety of temperature ranges in the 0-3000 F span.

Mail the coupon for complete information about Type HP pyrometers.



New Shadow-proof Temperature Indicators Are Easier to Read

Temperatures from −100 F to +300 F can now be accurately indicated and controlled with General Electric's new line of temperature indicators. These instruments can be read from almost any angle. The dial is set forward, flush with the front of the case. A protruding convex-type glass front provides clear illumination. No more cover overhang; no more shadows caused by overhead lighting. Two sizes available—$4\frac{1}{4}$- and $8\frac{3}{4}$-inches. Check coupon.

New Resistance Thermometers Accurately Indicate and Control Low Temperatures

TEMPERATURES FROM −100F to +300 F can now be accurately indicated and controlled with General Electric's new line of resistance thermometers. They indicate accurately within $\frac{3}{4}$ of 1 per cent full scale. Any change in temperature equivalent to 1/10 of 1 per cent full scale starts immediate control action.

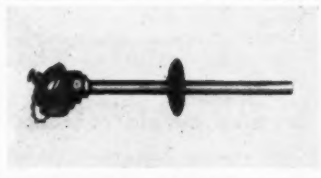
Normal changes in humidity or room temperature do not affect the exactness of control. Neither does a change in control voltage. Sturdy, simple construction assures reliable operation under severe operating conditions.

NARROW TEMPERATURE SPANS, as small as 90 degrees, are available anywhere in the −100 F to +300 F range. You can buy four types of resistance thermometers—indicators, protectors, and two- or three-position controllers—for either flush or surface mounting.

For complete information, mail the coupon below.

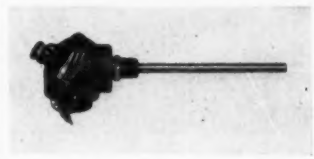
THERMOCOUPLE POTENTIOMETER measures temperature in locations inaccessible to glass-stem thermometers. Any number of different readings can be taken in rapid succession and accurate within ±0.2% of full scale.

Typical applications include refrigerator-development work, oil-burner and air-conditioning tests, steam temperature measurements, and heat-run tests on electric equipment. For complete information, mail the coupon below.



THERMOCOUPLES, COMPONENTS, AND ACCESSORIES for your pyrometer installations include protecting tubes and wells, thermocouple wire, ceramic insulators, extension wire, connectors, heads, selector switches. Send coupon today for catalog to help you obtain proper thermocouple assemblies.

Resistance Bulbs Accurate Within ±1 F between −100 F and +300 F



FOR ANY RESISTANCE THERMOMETER INSTALLATION, new G-E resistance bulbs offer a high degree of accuracy and reliability. They're available either with completely enclosed terminal head or without terminal head and with four feet of flexible cable. Units will retain calibration within 0.1 F. For complete information, mail the coupon below.

SECTION B602-227, GENERAL ELECTRIC
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Please send me the following bulletins: Indicate:

√ for reference only
x for planning an immediate project

- ☐ Resistance Thermometer (GEC-835)
- ☐ Resistance Bulb (GEC-835)
- ☐ Type HP-3 Pyrometer (GEC-713)
- ☐ Temperature Indicators (GEC-2188)
- ☐ Thermocouples, Accessories (GEC-714)
- ☐ Thermocouple Potentiometer (GEC-245)

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GENERAL ELECTRIC

Morse **HY-VO** Drive for a new age in power transmission

New Hy-Vo Drive

runs at amazing velocity on continuously operated pump

Above, you see a sensational, new Morse Hy-Vo Drive that replaced a conventional drive over twice its width on an irrigation pump.

This relatively narrow Hy-Vo Drive, 1½" pitch by 3" wide, transmits 300 HP at 514 RPM continuously, *with chain velocity of 4600 FPM.* Hy-Vo cuts costs per operating hour up to 50%, gives up to one-third longer service life.

Morse Hy-Vo transmits more horsepower at greater speed and lower cost than any other standard means of power transmission: up to 5000 HP at 1200 RPM. Rotative speeds up to 3600 RPM. Linear velocities up to 6500 FPM. And 99.5% efficiency, to boot!

Stymied by old concepts?

Now, you no longer need be held back from getting more speed and power from your present motors or from new, smaller, higher-speed motors; from doing away with cumbersome, expensive outboard mounts and accessories; from sending far more power over a far narrower, lighter, less-expensive drive. These are but a few of the new concepts Hy-Vo is offering to American industry.

Hy-Vo is the latest addition to a complete line of power transmission equipment that has earned Morse its reputation for excellence in product design, manufacture and performance.

Let us send you Hy-Vo Catalog C 72-51—or information on Morse Silent Chain Drives, Morse Flexible Couplings, Morse Drive Shafts, or Morse Clutches. (Hy-Vo orders must carry priority rating at present time.)

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MECHANICAL POWER TRANSMISSION PRODUCTS
PRODUCTS OF BW BORG-WARNER

More than ever, M = PT—Morse means Power Transmission.

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Branch offices serving the petroleum industry: Houston, Texas, 1312 LaBranch Avenue, P.O. Box 896; Pasadena, California, 1571 Harding Avenue; Pittsburgh, Pennsylvania, 503 Martin Building.

CONCORD #20 Steam Hose

Tube swelling is the common failure that kills most steam hose . . . but this weakness can't shorten the life of CONCORD #20 Steam Hose.

Because here's the hose with the guts built-in . . . a special stainless steel inner wire braid that means this hose *will never swell.*

You'll never have to worry about tube constriction, you'll always be able to depend on full pressure flow.

CONCORD #20 . . . flexible, tough, dependable! Contact your Happy man — *do it today.*

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BULWARK OF FREEDOM, AND . . .

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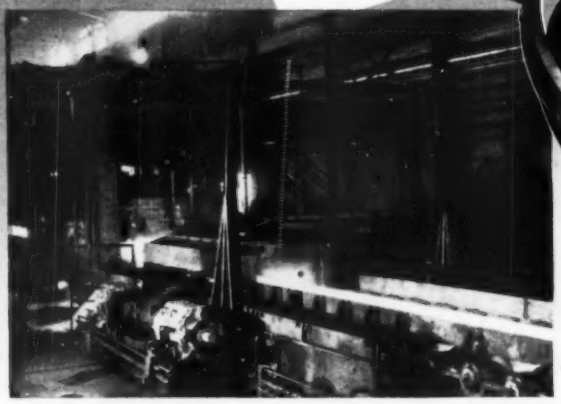

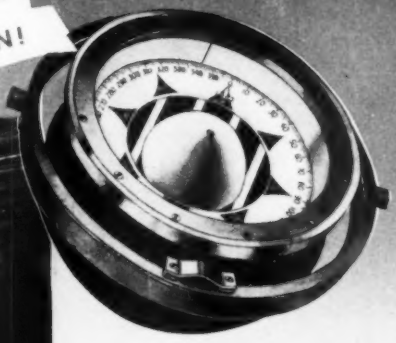

BLOOMING THE INGOTS

Steel, like dough for bread, must be kneaded, rolled and worked from ingots weighing several tons down to many shapes and sizes. First in the series of such processes is the giant blooming mill of which Sheffield has installed the most modern type.

SINCE Colonial times industry has been on the move, migrating from the Northeast—West, Southwest—with iron and steel providing the means and in many cases, the motive.

West of the Mississippi and East of the Rockies, Sheffield Steel and its forebearer have successfully navigated the uncharted course of steel production since 1888. First, and still the only fully integrated steel mill operation in Mid-America, Sheffield continues to devote an ever-expanding production to a wide diversity of the particular kinds of steel products most needed in the industrial growth of the region.

Within the last ten years, the industrial growth of the region has shattered all records. So, too, has Sheffield Steel in expanding some of its facilities as much as $3\frac{1}{2}$ times, and marking up an overall capacity increase, at its three plants, of over 100% as compared to 25% for the steel industry as a whole.

SHEFFIELD
STEEL
CORPORATION
HOUSTON KANSAS CITY
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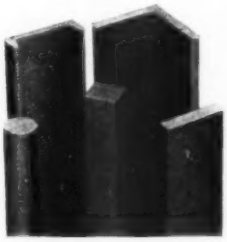
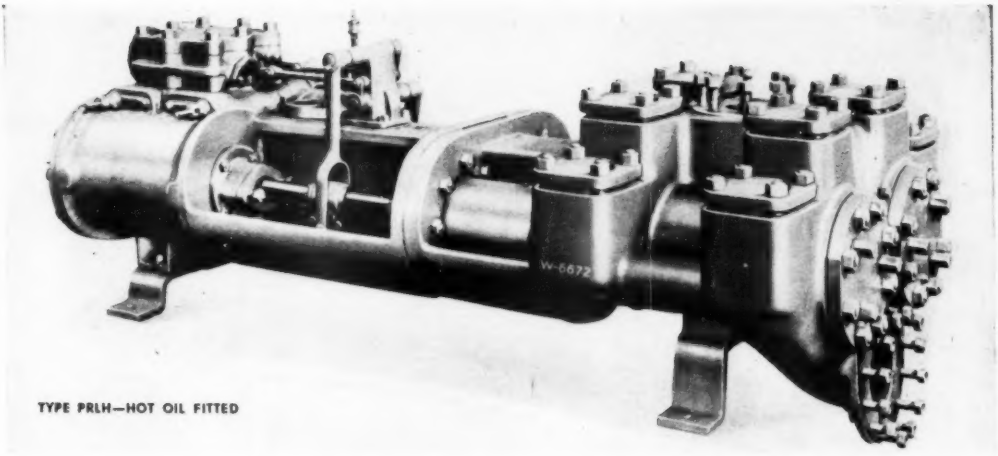
SUBSIDIARY OF ARMCO STEEL CORPORATION

SHEFFIELD MERCHANT STEEL

Almost every industry uses merchant steel in product manufacture or in maintenance of plant and operating equipment. Capacity for rolling bars and shapes at Sheffield Steel Plants has been greatly expanded by the installation of highly mechanized merchant mills of the most modern type.



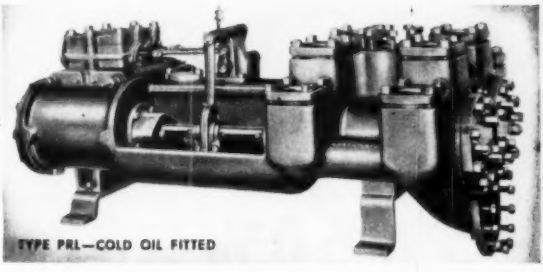
IRON AND STEEL *SCRAP* MEANS . . . . . **MORE STEEL FOR AMERICA** *More Money In Your Pocket!* *GET YOURS OFF TO* THE DEFENSE LINES NOW!



TYPE PRLH—HOT OIL FITTED

We've Built New and Superior Strength into

Worthington Steam Pumps



TYPE PRL—COLD OIL FITTED

NEW STEAM ENDS RATED UP TO 250 PSI

Steam cylinders and flanges designed for 250 psi maximum working pressure hydrostatically tested to 375 psi . . . Drop-forged steel steam valve gear . . . Heavier piston rods . . . ½ in. minimum drain openings allow heavier pipe connections . . . Those are some of the *strength features* built into Worthington's new line of steam pumps for refinery service.

MORE FEATURES OF ADVANCED DESIGN

Then, for *longer wear*, the steam valve gear is lubricated—oil cups on the rocker arms give longer bearing life.

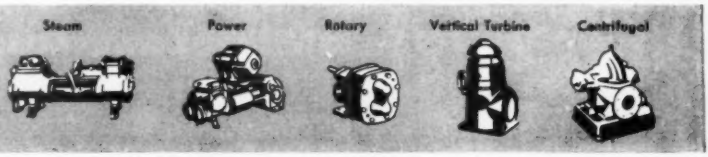
And *accessibility:* two-piece piston rods, either part removable without disturbing the other end . . . flanging on steam cylinder permits easy lagging . . . external cushion valves (on larger sizes).

This new line of duplex steam pumps represents Worthington at its best—the broadest range, the finest engineering. It's one more proof that *there's more worth in Worthington*. For information about specific pumps, write Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.

WORTHINGTON

P.1.3

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



extra thruput GUARANTEED

UP TO 50% EXTRA THRUPUT OBTAINED
BY USING KOCH KASKADE FRACTIONATING TRAYS

LEONARD REFINING CO.
ALMA, MICHIGAN

Obtained increased thruput on 72" I. D., TCC synthetic crude tower to capacities of:

	Liquid	Vapor
Volume	115,300 ≠/hr.	82,480 ≠/hr.
Density	45.1 ≠/cf.	175 ≠/cf.
Δp/tray	.....	1.38" H_2O

Koch Kaskade trays were installed on present supports — 36" centers.

PHILLIPS PETROLEUM CO.
WOODS CROSS, UTAH, REFINERY

Obtained increased thruput on 30" diameter, 110≠ psig. poly stabilizer to capacities of:

	Liquid	Vapor
Volume	36,700 ≠/hr.	20,000 ≠/hr.
Density ≠/CF	29.6	1.317

Koch Kaskade trays were installed on 24" centers.

WARREN PETROLEUM CO.
RINGWOOD, OKLA., GASOLINE PLANT

Obtained increased capacity on 72" 750≠ natural gas absorber to:

	Liquid	Vapor
Volume	460 gpm (lean)	75 mm. CF/D
Density ≠/CF	38° API (lean)	2.43 ≠/CF

Koch Kaskade trays were installed on 26" centers.

When extra thruput is your problem, it will pay you to investigate the economy and operating efficiency of Koch Kaskade Fractionating Trays. Write us today — no obligation.

KOCH ENGINEERING COMPANY, INC.
DESIGNERS • MANUFACTURERS • BUILDERS
REPRESENTATIVES

They Say—

No So Esthetic

"Poets have been inspired to flights of eloquence by the skyline of derricks in the Long Beach oil fields, especially the picturesque if antiquated wood structures of the Signal Hill area. Other and more practical-minded observers are often moved to ask, 'Why are they left standing after they have become useless and dangerous?'

"In recent months city building and safety officials have been asking the same question. Since the first of this year, more than 40 of the old derricks have been removed, either voluntarily by the owners or as a result of condemnation by the city. All had been eaten by termites or otherwise damaged by time to a point where they were obviously unsafe. Several of the same type had been demolished by wind before the condemnation program was started.

"So now the forest-like skyline is gradually thinning out. It will never be the same again.

"Those massive wooden rigs that sprang up so rapidly during the twenties wear a certain charm, particularly if one happens to own an interest in the oil beneath them, but their esthetic value vanishes upon closer view. Even the poet who has seen some of them waver in a moderate breeze will have to agree that the city's safety project is overdue."

Editorial in the Long Beach Press-Telegram.

Iran Expects No Assistance

Sir:

. . . It is gratifying to know that you have tried to give an unbiased account of conditions in Abadan but I do not agree with your forecast of the future. You will have read that we have already started processing some 2,500,000 Imperial gallons of crude oil per day and are manufacturing specification motor spirit, kerosine, gas oil, fuel oil, and bitumen and the various process units involved in this circuit are all functioning very satisfactorily. Except for our tankage which is almost full we believe we could increase our throughput to about 9,000,000 tons a year with the help of our existing Iranian staff.

In addition to Agha-Jari field which is supplying the crude oil needed for our present intake into refinery we have started producing on a small scale from Masjid-i-Suleiman and are using one of the topping plants there to supply specification fuel oil required for internal consumption in Iran. . . .

In conclusion I would add that we do not expect any positive action or assistance from European or American governments but so long as they do not produce obstacles in our way we are confident we shall be successful in the arduous task which lies ahead.

M. Bazargan,
Chairman, Provisional Board of Directors,
Iranian National Oil Co.,
Khorramshahr, Iran.

First Line of Defense

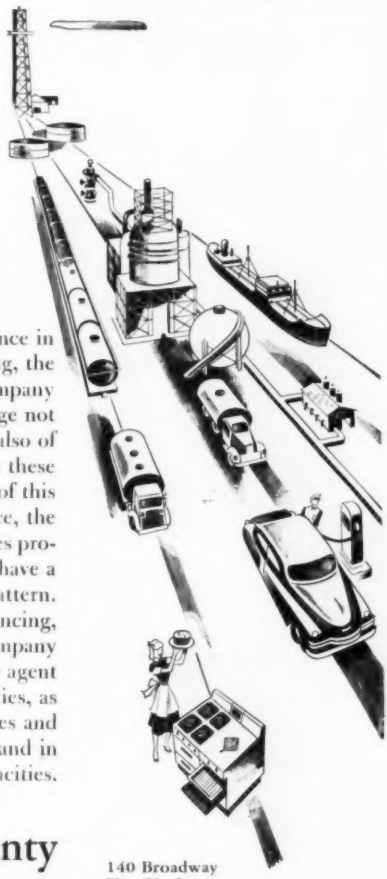
"A strong domestic industry provides the first line of defense against any aggression that threatens our country and supplies an immediate source of available petroleum products for such countries as may be allied with us in the defense of ideals essential to world peace.

"It is, therefore, essential that we maintain our strength and be constantly alert as to the needs of our own welfare.

"Our second line of defense, we have been told, is provided through the ability of other countries of the Western Hemisphere to maintain for their own use and available to us, supplemental petroleum supplies that may be used not only for their own armed forces, but be available to supplement our own supply when needed."

Russell B. Brown, general counsel.

Serving the Expansive Oil and Gas Industries



Through long experience in oil and gas industry financing, the Guaranty Trust Company has a broad knowledge not only of the problems but also of the achievements in these industries. As a result of this accumulated experience, the banking and fiduciary services provided by this Company have a flexible and responsive pattern. In addition to direct financing, the Guaranty Trust Company acts as registrar and transfer agent for oil and gas securities, as trustee of bond issues and pension trusts, and in related capacities.

Guaranty Trust Company of New York

Capital Funds $378,000,000

Member Federal Deposit Insurance Corporation

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Fifth Ave. at 44th St.
New York 18

Madison Ave. at 60th St.
New York 21

Rockefeller Plaza at 50th St.
New York 20

London Paris Brussels

When the Chips are Down

Count on GUIBERSON TYPE "J" ROTATING DRILLING HEAD

Reversing dollars out of the hole? Yes—very seriously, there is a great saving to be had on many wells by using *reverse circulation.* The Guiberson "J" Head not only gives the ultimate in reverse circulation performance, but is a packed off rotary table with both kelly drive and tubing slip mechanism integral. This is incorporated in one short assembly. The fact that circulation can be in either direction at will is particularly advantageous when the operator is alternately drilling and washing a production zone. Kelly pack-off rubber turns with kelly for an effective pack-off with longer life.

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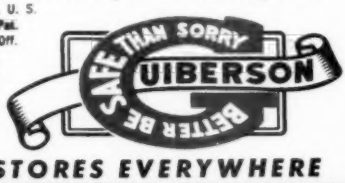

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"In considering the quality of premium-grade gasoline, it is necessary to realize that it is impractical to adjust this gasoline to a level where all knocking is eliminated from all cars on the road. Raising already high octane numbers can do little for a car in improper condition, but competent mechanical attention can add power and economy as well as eliminating the knock."

W. S. Mount, manager of the product-engineering division of Socony-Vacuum Oil Co., Inc., before the southern California section of the Society of Automotive Engineers.

Oil Men Meet the Challenge

"The last year for oil men has been one filled with four-fold problems labeled 'guns, butter, Korea, and Iran.' American oil men have met and mastered every one of these challenges.

"In 1951 we have set new crude-oil-production records; we have set new refinery-throughput records; we have met critical demands for unusual quantities of special products such as aviation gasoline, jet fuels, petrochemicals, and the like.

"We have kept factories humming throughout the Western world that normally are supplied by Iran's Abadan refinery, and we have laid the groundwork for new growth that will enable us to achieve output records tomorrow that will dwarf those we are so proud of today.

"The ability of the American oil industry to meet national crises is no accident. Oil men have traditionally believed in abundance."

V. A. Bellman, vice president of marketing, General Petroleum Corp., Los Angeles, before the Pacific Supply Cooperative.

CALENDAR

1952 Meetings

January

Pipe Line Contractors Association, annual meeting, Shamrock Hotel, Houston, January 8-9.

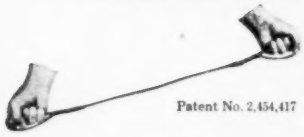
Society of Automotive Engineers, annual meeting, Hotel Book-Cadillac, Detroit, January 14-18.

Compressed Gas Association, Inc., annual meeting, Waldorf-Astoria, New York City, January 21-22.

February

American Society for Testing Materials, Committee D-2 on petroleum products and lubricants, Shoreham Hotel, Washington, D. C., February 3-8.

MAKE THIS TEST YOURSELF...WITH A FREE Tuffy® SLING



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Missouri Petroleum Association, annual convention and trade exhibit, Jefferson Hotel, St. Louis, February 4-6.

Instrument Society of America, New York Section, power-plant symposium, Hotel Statler, New York City, February 7-8.

American Petroleum Institute, Division of Marketing, lubrication-committee meeting, Hotel Book-Cadillac, Detroit, February 18-19.

Wisconsin Petroleum Association, twenty-sixth annual convention and equipment show, Milwaukee Auditorium, Milwaukee, February 26-27.

American Association of Petroleum Geologists, Rocky Mountain Section, annual meeting, Salt Lake City, February 28-29.

March

American Society for Testing Materials, spring meeting, Hotel Statler, Cleveland, March 3-7.

American Petroleum Institute, Division of Production, southwestern district, Washington-Youree Hotel, Shreveport, March 5-7.

National Association of Corrosion Engineers, eighth annual conference and exhibition, Galvez Hotel, Galveston, Tex., March 10-14.

American Institute of Chemical Engineers, regional meeting, Atlanta, March 16-19.

American Petroleum Institute, Division of Production, Mid-Continent district meeting, Broadview Hotel, Wichita, Kans., March 21.

American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, and Society of Exploration Geophysicists, joint annual meeting, Biltmore Hotel, Los Angeles, March 23-27.

Western Petroleum Refiners Association, annual meeting, Plaza Hotel, San Antonio, March 31-April 2.

April

American Petroleum Institute, Division of Production, eastern district, Hotel William Penn, Pittsburgh, April 2-4.

Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, April 8-10.

American Institute of Electrical Engineers, District 7 meeting, Hotel Jefferson, St. Louis, April 15-17.

American Petroleum Institute, Division of Transportation, pipe-line conference, Blackstone Hotel, Fort Worth, April 21-23.

American Petroleum Institute, Division of Production, Rocky Mountain district, Gladstone Hotel, Casper, Wyo., April 24-25.

Southern Gas Association, annual convention, Galveston, Tex., April 28-30.

Society of Exploration Geophysicists, Gulf Coast regional meeting, Rice Hotel, Houston, May 29-30.

American Institute of Electrical Engineers, District 1 meeting, Binghampton, N. Y., April 30-May 2.

Natural Gasoline Association of America, annual meeting, Rice Hotel, Houston, April 30-May 3.

May

American Geophysical Union, thirty-third annual meeting, National Academy of Sciences, National Research Council, Washington, D. C., May 5-7.

American Institute of Chemical Engineers, regional meeting, French Lick, Ind., May 11-14.

American Association of Petroleum Geologists, regional meeting, Mayo Hotel, Tulsa, May 12-13.

American Gas Association, Natural Gas Department, spring meeting, Biltmore Hotel, Los Angeles, May 12-13.

American Petroleum Institute, Division of Refining, seventeenth midyear meeting, San Francisco, May 12-15.

American Petroleum Institute, Division of Production, Pacific Coast district, Biltmore Hotel, Los Angeles, May 15-16.

American Petroleum Institute, Division of Marketing, midyear meeting, Copley Plaza Hotel, Boston, May 19-20.

Gas Appliance Manufacturers Association, annual meeting, Broadmoor Hotel, Colorado Springs, Colo., May 21-23.

American Gas Association, production and chemical conference, Hotel New Yorker, New York, May 26-28.

June

Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh, June 5-6.

Canadian Gas Association, Chateau Frontenac, Quebec, June 8-12.

American Petroleum Institute, midyear standardization meeting, Brown Palace Hotel, Denver, June 9-14.

Petroleum Equipment Suppliers Association, Mark Hopkins Hotel, San Francisco, June 22-25.

American Society for Testing Materials, annual meeting, Hotel Statler, New York, June 23-27.

American Institute of Electrical Engineers, summer general meeting, Hotel Statler, New York City, June 23-27.

September

American Institute of Chemical Engineers, regional meeting, Palmer House, Chicago, September 11-13.

American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City, September 27-30.

NOMADS

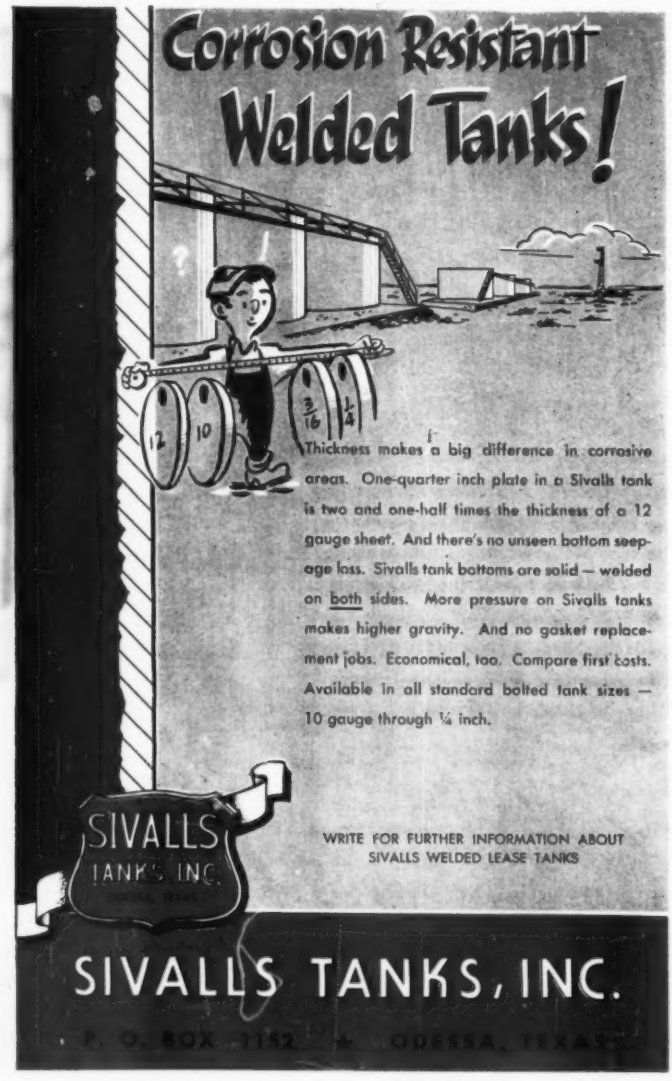
Tulsa Nomads, third Friday of each month. After Five Room, Tulsa Hotel.

Tulsa Nomads, annual ball, Mayo Hotel, January 18.

Dallas-Fort Worth Nomads, first Monday of each month, Greater Dallas Club.

Houston Nomads, second Monday of each month, Ye Olde College Inn, Houston.

Los Angeles Nomads, second Wednesday of each month, Jonathan Club.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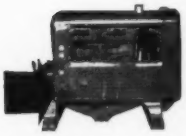

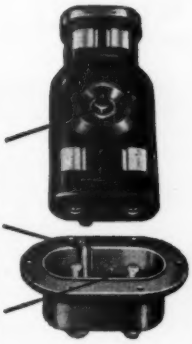

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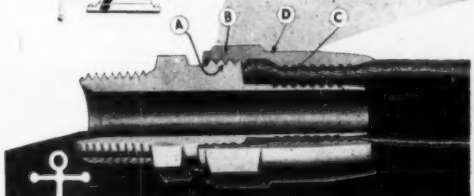

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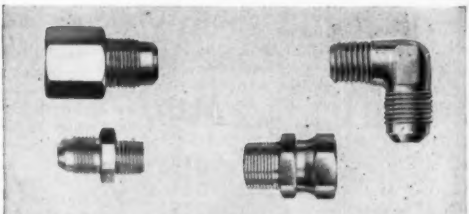

Straight adapters, 90° elbows, adapter unions and related fittings make piping easier.

Also factory-assembled ductile sleeve couplings and field-service clamp-type couplings.

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JOURNALLY Speaking

What of '52

HERE we are again at that traditional "Eve" when we all ring bells, blow horns, wish everybody a Happy New Year, and make predictions of what is going to happen during the next 12 months.

What is there to indicate that 1952 will be a particularly happy new year for the oil industry? Well, without sermonizing on the subject we could point out that things are never so bad but what they could be worse, but we're not going to make any specific predictions about the future of the oil industry until we get a peek at the January 28 issue of our favorite oil publication. That's our annual review and forecast number, and even if we hadn't broken our crystal ball we wouldn't want to jump the gun on the predictions our experts are now doping out.

That Word Again

THIS business of how to spell Uinta or Uintah has got us so groggy we can't even pronounce the word any more, let alone write it. Every time another well is brought in up there we cringe inwardly. And brother, are we hearing about it. For instance, here's a sample letter:

"Your topic 'Spelling in Utah' in the November 22 issue of your 'favorite oil publication' might better have been labeled 'Spelling in Oklahoma,' or, still more appropriately, 'Proofreading in Oklahoma.' Of the seven times in which the name 'Uinta' or 'Uintah' appeared in your article the 'n' and the 'i' were transposed four times. Maybe you should have quit when you were ahead."

Maybe we should have quit period. Editors can always blame proofreaders for everything, but we have enough arguments with our proofreaders as it is so we're not even going to try to track down what happened to "that word." In the same mail we got another letter from a reader who went to considerable research in order to be helpful:

"Before you get to knocking the 'h' out of Uintah recklessly, you ought to know that the Indian Agency at Fort Duchesne, Utah, has something to say on the question. Its style calls for Uintah in all cases except the Uinta National Forest.

"My road map insists on Uintah and Ouray Indian Reservation, Uintah Canyon Recreational Area, and Uintah County, but Uinta Mountains and Uinta Valley.

"The American Association of Petroleum Geologists backs up the Uinta basin spelling that most geologists seem to prefer. Hammond's New World Atlas refers to Uinta Mountains, Uinta Base Line, Uintah County (Utah), and Uinta County (Wyoming).

"Wouldn't it be terrible if the Ute Indians in the Uinta country spoke Cockney English?"

It's terrible anyway, and the above "help" leaves us where we came in—which is confoosed. Maybe we ought to ask the Secretary of the Interior to convene a special meeting of the Board on Geographic Names.

Quiz Corner

LIKE puzzles? Try your hand on our "beat the experts" game, starting on page 66 of this issue. Here's a chance to test your knowledge on every division of the oil industry. Whether you score well or not, write and tell us if you like the quiz and want another soon. We'll never know unless you tell us.

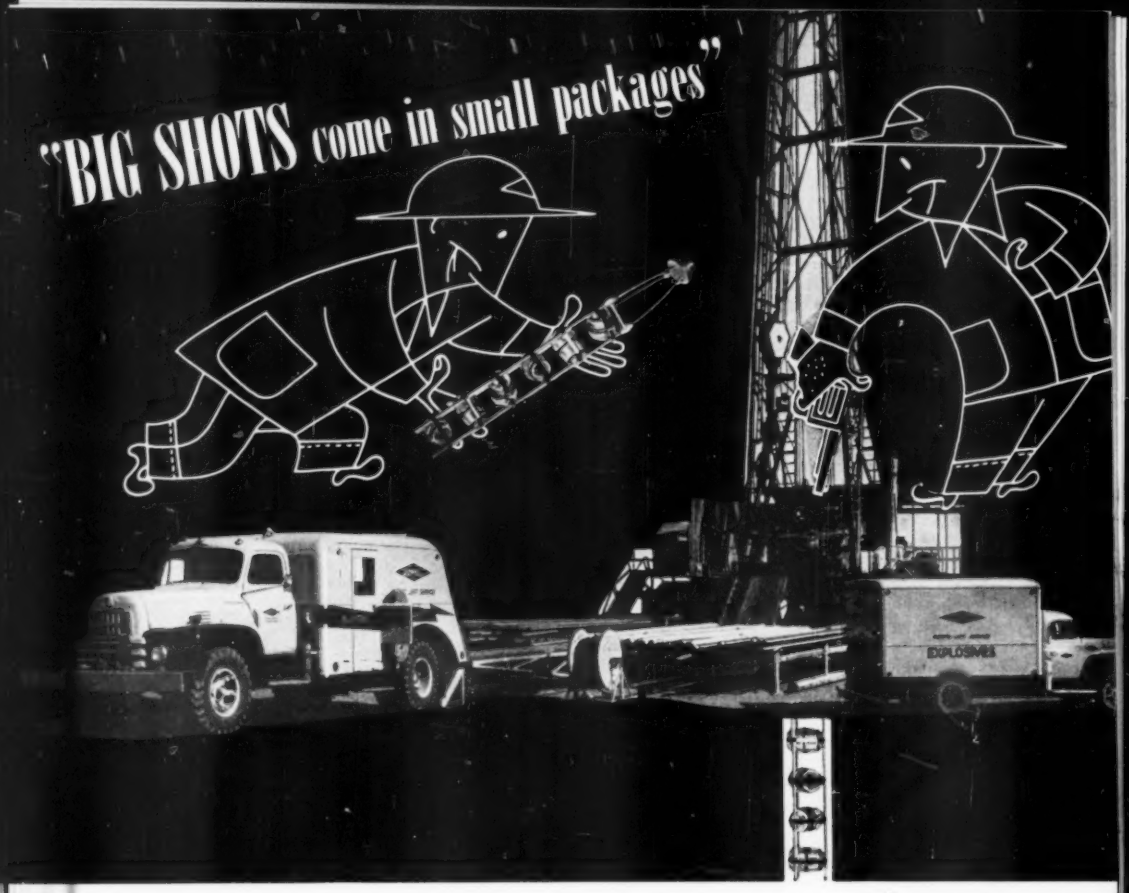
Slight Shift

THIS is the last issue of the Big Yellow Book you will receive on the mail delivery to which you have become accustomed. The issue after this one will be dated January 7, and you may expect to receive it on that day unless you live more than 2 days' train travel from Tulsa.

That means there will be 10 days between the dates of this issue and the next one, instead of the customary 7. But you won't get gypped, because there are 52 Mondays in 1952, so you will get your full money's worth out of the subscription price. (Our editors insist you would get more than your money's worth if the price were 10 times as much, but we won't go into that now.)

As previously explained, the change in publication date is designed to give better service to our readers, so don't be annoyed if you have to wait an extra 3 days for the next issue. We hope you'll like it. Happy New Year.

Henry D. Ralph



DEEPER PENETRATION with Dowell Glass Gun in casing perforating or open hole shooting

When you ask for Dowell Perfo-Jet Service, you receive the latest advancements in oil and gas well perforating! Now, Dowell has developed an expendable Glass Gun that allows the use of a larger explosive charge than do other types of guns. This extra detonating power gives you deeper, surer penetration of casing, cement and formation. Comparative "Standard drum tests" through 7" O. D. casing into cement and sand show the following results:

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December 27, 1951

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Unless you are using Baker "Whirling" Cementing Equipment, you probably are wasting valuable rig time in *running* and *cementing* casing.

It takes mighty little wasted rig time to pay the difference in cost between ordinary shoes and Baker "Wash-Down Whirler" Shoes which do the *best* possible cementing job in the *shortest* possible time.

Here's the hook-up you need

See at right the Baker Wash-down Whirler Guide Shoe which removes bridges, conditions the hole, and whirls the cement to assure complete encasement of the casing which is centered by a Baker Casing Centralizer. If your well is extra deep, use a Baker Wash-Down Whirler *Float* Shoe in place of the *Guide* Shoe, and have two float valves in the string. The Baker Cement Float Collar, up the string, not only serves as an efficient back-pressure, or float valve, but provides a stop for the cement plug.

You won't waste *any* time with this hook-up—and see below why it is always your best bet for cementing casing.—Specify, and be sure you *get*, Baker "Whirling" Cementing Equipment.

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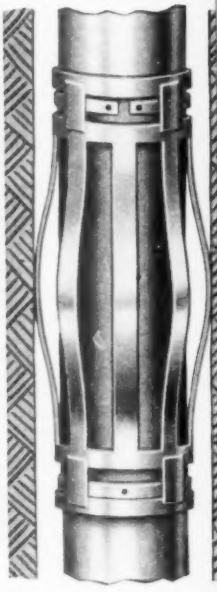
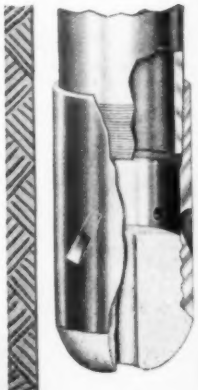
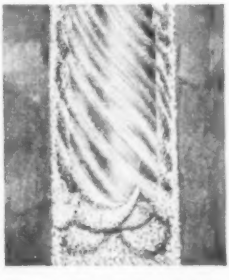




Here is visual proof of what *whirling* does for you...

The downward hydraulicking action of the circulating fluid through the baffled side down-whirler ports and the restricted bottom passageway, effectively remove bridges and permits safe running of the string of casing.

When washing the formation at the cementing point to condition the hole, the "whirling" motion of the fluid helps remove mud cake from side walls. This *downward* whirling is far superior to any *side jetting* action, and does not cause caving or crumbling of soft formations.



The "whirling" motion given to the cement slurry as it is discharged from a Baker Wash-Down Whirler Shoe causes the cement to encase the centered shoe joint with a more uniform body of cement, and reduces to a minimum the hazard of channeling.

Year In, Year Out

For the petroleum industry, the year just closed was an unusual year in many respects. The industry had to cope with the threat of war, with shortages of materials, with rising costs, higher taxes, frozen prices, and an unexpectedly heavy demand.

Yet in spite of these and other obstacles the industry set new records of achievement in virtually every division. The final score for 1951 is not yet totted up in full detail, but it is evident that during the year the industry met demands about 10 per cent higher than last year. To do this it drilled more wells than ever before and produced more crude oil, more natural gas, and more liquefied light hydrocarbons.

It spent more money than in any previous year, too, enlarging its facilities of every sort, notably expanding the mileage and capacity of its network of pipe lines and its ability to process crude into refined products. At the same time the quality and diversity of its products increased, and big strides were made in the relatively new field of petrochemistry.

While setting these records of production, transportation, and processing, the industry increased rather than diminished its ability to meet even greater requirements in years to come. Its proven underground reserves were maintained at a safe level and its reserve producing capacity was built up substantially after a temporary decline. It demonstrated that it can find huge new supplies of oil, as in the Spraberry trend and the Williston basin, and it continued its rapid progress in conservation of present supplies by utilization of flare gas and secondary-recovery methods.

These accomplishments were made doubly difficult by the unusual circumstances of 1951, which included such handicaps as the need to make up to the world the loss of Iranian output, the demands of the military for special products and processing facilities, a growing shortage of steel, and the many controls and restrictions dictated by the defense program.

An unusual year, we said? Well, not so unusual, after all. Every year presents so many challenges and unexpected problems that the unusual has come to be usual in the oil business. Breaking previous records is usual, and it would be an unusual year indeed that did not turn up some entirely unforeseen difficulties and new problems.

The industry can meet unusual conditions because of its flexibility, initiative, and resourcefulness, and these qualities are due to the fact that it is made up of hundreds of individual, competitive enterprises which give it a resilience and drive enabling it to cope with almost any obstacle.

The coming year will bring new and different problems, but there is no reason to doubt that the industry will meet them as it always has in the past. No matter how unusual the demand or the difficulties, petroleum can be counted on to meet and anticipate the requirements of its customers and the nation year in, year out.

PLANNED PIPE.—Government agencies this week revealed details of their system of allocating steel to meet the programed needs of the oil and gas industry, announced allocations of tubular goods to drillers and producers, proposed a new method for scheduling the rolling of line pipe, and warned that steel will be scarce all next year.

THIS WEEK

STEEL.—Distribution setup of PAD on tubular goods designed to allow operators to drill at same rate they did before materials shortages, Brown says. . . . Inventories play big role in third, fourth-quarter allocations of casing, tubing. . . . ¶Oil and gas industry's allocations of vital metals to be kept at minimum to assure attainment of production, refining goals set by PAD, but defense effort will cut sharply into supplies during 1952. . . . ¶NPA seeking assurance from steel mills that line pipe for vital pipe-line projects will be available. . . . ¶PAD asks refiners, producers to step up their scrap-collection programs. . . . ¶Export quota of 150,000 tons of carbon steel for foreign oil operations set for first quarter of 1952 by OIT. . . .

PRODUCTION.—Unusually high stocks cause Texas Railroad Commission to slash 86,825 bbl. daily off January crude-oil allowable. . . . More reserve producing capacity cited as United States' first need. . . . ¶Louisiana allowable raised slightly to 647,359 bbl. daily. . . . ¶Unitization of Kelly-Snyder, Diamond M fields in Scurry County, Texas, nears. . . . World crude-oil production gained 135,000 bbl. in October, to 11,893,800 bbl. daily.

PRICES.—Refiners demanding higher price ceilings for petroleum products, if OPS takes any action to raise crude-price ceilings. . . . I.P.A.A. says it opposes requested 7 cents per barrel increase for Spraberry crude unless product prices are raised at the same time. . . .

INDUSTRY.—Petroleum and natural-gas industries set many new records in 1951, with demand for products, capital investments hitting all-time highs. . . . ¶Texas to log a total of more than 1 billion barrels in crude, condensate production in 1951, representing a gain of 20 per cent over 1950. . . .

CANADA.—Construction on Trans Mountain's new 75,000-bbl., 693-mile, 24-in. crude-oil line from Alberta to the Pacific Coast will get under way next spring. . . . All contracts let. . . . ¶Imperial Oil increases tank-wagon prices on heating oils, diesel fuels on the prairies. . . . ¶Canadian Industries, Ltd., to build first plant in Canada for manufacture of polythene at Montreal. . . .

ACTIVITY.—Crude production averaged 6,134,725 bbl. daily for the week ended December 22, down 8,855 bbl. daily. . . . ¶Total completions increased 2 wells to 947. . . . Wildcat completions totaled 209 compared with 219 for previous week and 152 for the same week last year. . . . ¶Rotary rigs operating in the United States on December 17 decreased 27 rigs to 2,994, but the total was 599 rigs greater than for same date in 1950.

TRENDS.—Total demand for residual fuel for 5-week period ended December 15 was up only about 1 per cent from same period last year. . . . ¶Deliveries from domestic refineries and from inventories gained 6.1 per cent. . . . Residual imports decreased about 16 per cent. . . .

INTERNATIONAL.—Aramco to spend $20,000,000 on big pressure-maintenance plant for Abqaiq field, one of world's largest. . . . ¶A.I.O.C. warns prospective buyers of Iranian oil that legal action will be taken if any oil is purchased from its seized properties. . . . ¶Iraq Government takes over properties of two A.I.O.C. subsidiaries in Iraq, apparently by agreed purchase. . . .

REFINING.—Phillips plans immediate start on big petrochemical plant at Houston. . . . Interests in plant, projected originally by Alamo Chemical Co., purchased from General Aniline & Film Corp. and Borden Co. . . . ¶Eldorado Refining awards contracts for construction costing more than $3,000,000 at its Eldorado, Kans., refinery. . . . Program involves installation of new catalytic cracking unit, gas-concentration plant, and revamping of polymerization plant. . . .

Oil's Biggest Year

Demand during 1951 resulted in new records for drilling, production, refining, natural-gas operation, investments

NEW YORK.—Recorded accomplishments and record expenditures are the story of the oil industry in 1951.

During this biggest of all years in the industry's history, demand for products reached an all-time high, requiring record new capital investments and resulting in new peaks in drilling, production, and refining operations.

In a year-end analysis of the industry's achievements, Frank M. Porter, president of the American Petroleum Institute, reported that during 1951:

. . . **Total demand** (including exports) reached the all-time high of 2,724,000,000 bbl., almost 10 per cent above the previous record established last year and 71 per cent greater than that of 1941.

. . . **Domestic demand** climbed to 2,568,000,000 bbl., ninth consecutive yearly record and an 8 per cent jump from 1950's figure.

. . . **Production** totaled 2,245,000,000 bbl., an increase of 225,000,000 bbl. over the previous record set in 1948.

. . . **Refineries** processed 2,372,000,000 bbl., a gain of 250,000,000 bbl. over 1950.

. . . **Well completions** are expected to total 44,500, an increase of 1,200 over 1950's former record.

What it cost.—Porter estimated that the problem of meeting increased liquid-fuels demand and preparing for further increases resulted in the spending of an estimated 3 billion dollars during 1951.

This figure, he said, represents an increase of nearly 22 per cent over 1950 expenditures and brings the industry total for capital expenditures since the end of World War II to about 15 billion dollars.

"The defense effort, coupled with the every-day competition within the oil industry, will insure continued investment of the immense sums required for expansion and development to meet increasing demands," Porter said.

Natural gas. — In another report, released by the American Gas Association, capital expenditures of the gas industry in 1951 were set at $1,500,000.

Of this total, the A.G.A. said, nearly a billion dollars was spent on construction of natural-gas-transmission lines in an effort to meet the increasing public demand for natural gas.

The outlook for the future is for more expansion, the association said, with an additional $4,600,000,000 expected to be spent by the end of 1955.

During the year just ending, the A.G.A. said, the natural-gas industry increased the number of its customers by 14.2 per cent, while the manufactured and mixed-gas industry experienced a loss of 13.4 per cent of its customers.

The A.G.A. figures that expansion this year brought the natural-gas industry's total investment in plant and equipment to almost 9 billion dollars, making it the sixth largest industry in the nation.

For 1952 the association considers the outlook "favorable" in spite of such obstacles as the steel shortage and manpower problems.

Expansion factors. — Several reasons were cited by Porter for the continuing upward trend in demand for products, including (1) the nation's stepped-up mobilization and defense program, (2) increased use of products on farms, in factories, offices, and homes, and for transportation, and (3) the shutdown of operations in Iran, which necessitated a higher level of operation in this country to help offset the loss.

This country, Porter said, with roughly a third of the world's oil, accounted for 56 per cent of the world's total production for the year, an increase of 4 per cent from 1950.

World production during the year, he said, reached the all-time high of 3,986,000,000 bbl., up almost 200,000,000 over 1950. United States exports, he added, climbed 45,000,000 bbl. to 156,000,000 bbl. for the year.

Production.—Output of crude oil in this country exceeded 2 billion barrels for the second time in history and topped the old 1948 record by 225,000,000 bbl., Porter's report said.

Production of natural-gas liquids also took another big jump, climbing to 204,000,000 bbl., an increase of 20,000,000 bbl. over 1950.

Including these gas liquids, total production in the United States during 1951 was placed at 2,449,000,000 bbl., a mark which also passed the previous record set in 1948.

The A.P.I. report estimated 1951 natural-gas production at 9.8 trillion cubic feet, another new record and an increase of 1.32 trillion cubic feet over the preceding year.

Refining.—Capacity of the nation's refineries was expanded to a new high of 7,230,000 bbl. per day this year, compared with the 1950 year-end total of 6,963,644 bbl. per day, Porter said.

The 1951 expansion program, he said, put the nation's capacity to process crude oil 46 per cent ahead of that in 1941.

Gasoline production totaled 1,132,000,000 bbl., an increase of 10.5 per cent over 1950; gas oil and distillates recorded a 19 per cent jump to 475,300,000 bbl.; and residual-fuel output rose from 425,000,000 to 468,000,000.

Part of the big jump in distillate production was credited to the continuing dieselization of the nation's railroads and the increased sales of home oil burners.

Porter said that during the first 9 months of 1951, all but 16 of the 1,856 new locomotives put into service were diesel electrics and that at the end of September almost 99 per cent of all locomotives on order were diesels.

Sales of liquefied petroleum gas also went up during the year, reaching an estimated 3,943,000,000 gal., compared with 1950's total of 3,428,000,000 gal.

Petrochemicals. — A continuation of the "giant strides" of this close relative of the petroleum industry was forecast by Porter.

While there are no figures available yet on 1951 production, he said, there is little doubt that there was a substantial increase over 1950's output. He cited the present "record rate" of building of petrochem plants and said that projects announced, started, or just finished on the Gulf Coast involve the expenditure of more than a quarter-billion dollars.

To illustrate the growth of the petrochemicals industry, Porter compared 1950's production of 16,800,000,000 lb. with 1945's output of 12,700,000,000 lb., 1940's 1,078,000,000 lb., and 1925's 15,600,000 lb.

At the present time, he said, about 25 per cent of all chemicals made in the United States are petrochemicals.

U. S. PETROLEUM SUPPLY AND DEMAND
(Daily averages in thousands of barrels)

	1951	1950	1948	1941
Supply—				
Crude production	6,151	5,402	5,520	3,842
Natural gasoline, etc.	559	498	402	231
Imports, all oils	846	847	514	266
Total	7,556	6,747	6,436	4,339
Demand—				
Domestic demand	7,036	6,499	5,775	4,071
Exports, all oils	427	304	368	298
Total	7,463	6,803	6,143	4,369

Tubular-Goods Supply

PAD's distribution setup will allow operators to drill at the same rate they did before materials shortages

WASHINGTON. — Details of allotments of casing and tubing made for the third and fourth quarters on 5,079 applications from domestic operators were made public this week by the Petroleum Administration for Defense.

The information was prepared at the request of Rep. Wright Patman of Texas, chairman of the House small-business committee, who plans to hold hearings on steel allocations in the oil and gas industry next month.

Much additional information requested by Patman will be submitted as soon as an overworked PAD staff can get it together. The compilation of information on 165 Class B operators took more than 400 man-hours, and the Class A list contained some 3,000 names.

In his report to Patman, Interior Secretary Oscar L. Chapman pointed out that 2,731 Class A operators, who normally drill at the rate of 40 or fewer wells per year, were given 220,367 tons of casing and tubing for the third quarter and 1,617 were given 143,125 tons for the fourth quarter. In Class B, operators drilling more than 40 wells per year, 152 received 153,107 tons for the third quarter and 162 were allotted 240,217 tons for the fourth quarter.

Inventories play role.—In releasing the figures, Deputy Administrator Bruce K. Brown explained that while the Class B operators historically drill around 65 per cent of the total footage they received only 42 per cent of the tubular goods available for the fourth quarter because many of them had larger inventories than needed to carry on their regular drilling operations, whereas many of the smaller operators had no reserve stocks at all.

By the fourth quarter, however, these excess inventories had been reduced and the large operators got 63 per cent of the total casing and tubing distributed. As a result, while 25 of the 152 large operators filing applications for the third quarter received no allotments, only 18 of the 162 applications received for the current quarter were denied.

This action was taken in conformity with a PAD policy that no prioritites assistance would be given to any operator who already had available for his usual drilling activities more than a 90-day working supply of oil-country tubular goods, plus a reasonable working inventory, Brown explained. In some cases, he said, the operators' report showed they had inventories large enough to permit them to continue drilling at their usual rate for many months—in some instances for more than 2 years.

No discipline.—The denial of applications because of excess inventory was in no way a disciplinary measure, since the operators had acquired their stocks in the course of their normal operations. Where operators with large tonnages were deficient in certain sizes of pipe needed in drilling operations, PAD made allotments to permit them to fill out their stocks of needed sizes.

In the case of the Class A operators, 1,204 of 3,935 filing applications for the third quarter and 1,900 of 3,517 filing for the fourth quarter were given no allotments. In general, Brown explained, the denials were the result of failure of the operator to file before the deadline, failure to provide sufficient information, or because of excessive inventories.

Emergency allotments.—In addition to the allotments made directly to operators, 22,200 tons of casing and tubing are set aside each quarter for emergency allotments for wildcat drilling by Class A operators (Class B operators normally include their wildcats in their regular drilling programs).

A total of 19,820 tons in the third quarter and 21,809 tons in the fourth quarter was allocated in the form of drill pipe to both Class A and B operators. The total oil-country tubular-goods allotments, accordingly, were 415,494 tons for the third quarter and 427,351 tons for the current quarter.

Well completions.—Statistics compiled by PAD show that during the 11 months ended November 30, wildcat completions were 9,545 against 7,877 in 1950, up 21.2 per cent; total completions, all wells, were 40,361 against 39,918, with every expectation that the 1951 target of 43,900 will be attained; dry holes numbered 15,160 against 13,613, and total footage drilled was 155,191,197 against 146,189,402, up 6.2 per cent. The number of rotary rigs in operation at the close of the period was 3,016, and the average for the 11 months was 2,513 against 2,139 in 1950, up 17.5 per cent.

With but two exceptions, the allocations of tubular goods to Class A operators were under 1,000 tons. The exceptions were the third-quarter allocation of 3,423 tons to Dow Chemical Co., Midland, Mich., which was not for oil or gas wells but for brine and other wells; and the allotment of 1,056 tons for the third quarter to Southwest Exploration Co., Huntington Beach, Calif., which is engaged in offshore drilling. It was explained that the offshore wells go down 2,500 ft. and out under the ocean 2 miles, and the company now is drilling out in the second mile.

Allotments explained.—In setting up the distribution system now followed, Brown explained, "we believed that allotments to existing operators, large and small, should be large enough to permit each class to continue drilling at about the same rate as that at which they had been operating before the development of materials shortages. In addition, in order to step up oil and gas production to meet the growing demands of the defense mobilization program, we considered it desirable, where possible, to permit those operators who wished to do so to expand their drilling programs.

"No-history" operators.—"At the same time, however, it was obvious that provision would have to be made for operators who had not recently undertaken oil or gas drilling operations—so-called 'no-history' operators. Therefore we provided that after the normal requirements of operators already in business had been met through primary allotments of tubular goods, first consideration should be given to applications from 'no-history' operators in making supplemental allotments.

"A further factor that had to be taken into account in computing allotments on an equitable basis was the depth of wells drilled in the past and planned for the future. An operator drilling in Arkansas, for example, has to go down, on the average, only 4,000 ft. to reach the productive strata and so would use only about one-sixth of the tonnage of casing and tubing that another operator would need in South Louisiana, where wells may be drilled to depths of as much as 12,000 ft."

Data given.—The PAD list of allotments to Class A operators includes only the amount allotted for the third and fourth quarters. More detailed information, however, is given for the Class B operators (with their specific permission) on their 1950 operations, 1951 programs and inventories. This information is given for all operators.

The Class B tabulation shows that the operators in that group drilled 18,814 wells in 1950 for a footage of 87,288,409 ft., using 1,185,556 tons of tubular goods, and planned to drill 22,943 wells this year for a footage of 112,598,746 ft. which would require 1,711,225 tons of steel.

What's Ahead in Metals

Oil, gas industry's allocations to be kept at minimum; defense effort will cut sharply into supply during 1952

WASHINGTON.—The defense program will cut deeply into the nation's supply of vital metals through at least the first 6 months of next year.

Sixty per cent of the available aluminum, copper, and brass, and more than 40 per cent of the carbon steel will go to defense and defense-related production and construction during the first quarter of the year, and maybe even a larger slice in the second quarter.

Even with sharp cuts made in the requirements for the defense program there will not be enough metal to go around. Screened requirements for the first quarter run from 50 to 86 per cent above the allotments of the various metals based on supply.

Figures compiled by the Defense Production Administration demonstrate why the oil and gas industry's allocations are being kept at the minimum which still will permit attainment of the production and refining goals set up by the Petroleum Administration for Defense.

Carbon steel.—The estimated supply of carbon steel will be 19,385,000 product tons, of which 9,158,750 tons will go to defense and defense-related production and construction—42.1 per cent.

An estimated 2,300,000 tons of carbon plate steel will be available, of which 1,450,300 tons, or 56.2 per cent, is earmarked for defense. The situation is further aggravated by the fact that military demand is taking up most of the space of the heavy plate mills and it has been necessary to shift the civilian demand for plate to sheet mills.

Alloy steel.—Defense will take 956,000 tons, or 52.7 per cent, of the estimated 1,600,000 tons of alloy steel available. Petroleum production and refining, electric power, agricultural, construction and metalworking machinery, and other important industries will have to share and get along on what is left.

Stainless steel.—Virtually all of the nickel-bearing stainless steel is going to defense and defense-related needs, which will get 180,300,000 of the estimated 280,000,000 lb. of all stainless steel available.

A similar situation is shown in copper, brass, and aluminum.

Expansion plans.—The expansion program designed to provide a production of 120,000,000 tons of steel a year by the beginning of 1954 has now been completed—on paper. Certificates of accelerated amortization for approximately 23,000,000 tons in addition to the 100,000,000 tons of capacity in existence July 1, 1950, have been issued by the Defense Production Administration and no more certificates will be granted.

The 3,000,000 tons certified above the 120,000,000-ton target is "insurance" that the desired steel will be forthcoming. This cushion is necessary since the industry cannot maintain production levels at 100 per cent of capacity or better indefinitely; some present capacity for producing steel ingot can be expected to become obsolete and scrapped in the next few years; and there is no assurance that all of the tax certificates issued actually will be used.

To remain tight.—Meanwhile, the steel situation will remain exceedingly tight for some time to come. This was evidenced by a National Production Authority ruling that no steel or aluminum will be released for the production of motor-vehicle license tags for 1953 and it will be necessary for the states to use tabs on the plates they will issue for 1952. The saving will amount to about 10,500 tons of metal.

Pipe System Sought

NPA wants assurance pipe can be obtained from mill

WASHINGTON.—Plans for insuring that line pipe in the required sizes will be provided as needed for essential defense-supporting oil and gas pipe lines are being considered in the National Production Authority.

Any system worked out, it is indicated, will be applied regardless of demands for pipe for nondefense purposes.

The need for some method for improving distribution was brought out at a recent meeting of NPA officials and manufacturers of large-diameter line pipe who reported that while users of 16 to 22-in. o.d. pipe are having difficulty in getting their orders on mill schedules there is ample space open in mills producing pipe in 24 to 30-in. diameters.

One present difficulty appears to be the limited term on which steel allocations are made. The quarterly allotment system, manufacturers contend, makes it difficult to schedule and deliver plate steel for large-diameter pipe. Because of the time required to finance and plan projects and hire crews and lay the pipe, a lead time of from 6 to 12 months is often required to procure the necessary steel for a large project.

At the same time, the expense and time involved in changing mill facilities to produce different sizes of pipe makes it necessary for the mills to operate with a maximum backlog and a minimum of changes.

Time limit proposed.—The Petroleum Administration for Defense has suggested that one way to assure the best distribution of large-size line pipe would be to set a time limit in which holders of Controlled Materials Plan tickets should place their orders with the mills. During that period an effort would be made by the buyer to place his order, without or with PAD assistance. If the ticket could not be placed even with PAD aid it would be returned to the claimant agency and given to another purchaser who might require a size of pipe that would be available. As an offset for the buyer who could not place his order, he would receive early consideration in the following quarterly distribution.

Products Pricing

OPS warned crude-price hike would upset balance

WASHINGTON.—Higher price ceilings for petroleum products are being demanded by refiners as a condition in any action taken by the Office of Price Stabilization to raise crude-price ceilings.

The need for such action to retain the normal relationship between the two branches of the industry has been laid before OPS by the Independent Refiners Association of America, which opposes a requested 7-cent per barrel increase for Spraberry crude unless product prices are raised at the same time.

The association points out that there are other West Texas intermediate- grade crudes which are equally entitled to a similar increase and holds there is no reason to single out Spraberry, which represents less than 20 per cent of those oils.

Additional costs.—There is more than 163,000 bbl. per day of crude which should receive the increase now being considered for Spraberry alone, it was explained by Norman L. Meyers, counsel for the association. Such an adjustment would involve an increase of many millions of dollars annually to the refining industry, he said, and it is obvious that the additional cost must carry with it a corresponding increase in product prices, if the money is to be provided to pay for the crude. Only in this way, he warned, can the refining industry continue to operate on a stabilized and efficient basis in keeping with the objectives of price stabilization.

Refiners who have submitted their views to OPS stress the necessity for adjustments in crude-oil ceilings, but

WATCHING WASHINGTON

Bertram F. Linz

Quebracho Coming

The oil and gas industry may get more quebracho with which to drill more and deeper wells next year.

There apparently is plenty of quebracho on the market—distributors report importers are offering more than the 60 per cent of the 1950 base-period use to which drillers are limited—and the industry is pressing to have restrictions removed or, if that cannot be done, to have the quota increased to 80 or 90 per cent.

The quebracho situation is rather complicated. Because of limited supply, the vital necessity of assuring sufficient extract for the tanning of leather, the plan to stockpile it, and the belief the oil industry could use substitutes, the National Production Authority issued a limitation order, M-57, last April. NPA would have banned the use of quebracho in drilling entirely had it not been for representations by the Petroleum Administration for Defense that substitutes could not be used in all field situations and in all depths of wells and a warning by the industry that the production of substitutes was inadequate for the larger number of wells being drilled.

The present relatively good supply of the material is attributed to the reluctance of foreign producers and domestic importers and distributors to sell to the government for stockpiling purposes. The producers are fearful that the market might subsequently be depressed by release of the stockpile, while domestic sellers are suspicious of the renegotiation feature of government contracts.

Because of this situation, NPA officials are more receptive to warnings that unnecessarily severe restrictions on the use of quebracho may lead to serious results. The oil and gas industry is being called on to drill a maximum number of wells with a minimum of steel, and it is pointed out that improperly conditioned mud can result not only in decreasing the efficiency of drilling rigs but in loss of steel through injury to tools.

The whole problem is now being studied by NPA, and a decision is expected early next month.

A Good Deal?

Accelerated amortization of new facilities for the production of petroleum products, steel, and other sinews of war may turn out to be less of a boon than was anticipated a year ago when the program was initiated.

The quick write-off of investments was based on estimates that the peak of the mobilization program would be reached in 1953, and defense reqquirements thereafter would taper off rapidly. The idea was that refiners and others would be able to recoup a substantial part of their investment in new facilities during the period of large volume and big profits.

The rearmament program, however, is seriously behind schedule, even though it is contended in military circles that it is running about as expected. The tremendous military production that was supposed to start flowing this year will not begin until sometime in 1952 when the civilian economy will be put on a more-guns, less-butter basis.

According there is a spreading belief that the mobilization period may not be a matter of just a few years but may be strung out indefinitely. If this should be the case, holders of amortization certificates will find the quick write-off period is over while the defense boom continues for maybe several years.

This would mean that while big business and big profits continued, only the normal amortization could be applied against income and most of the remainder would go to the Treasury. The corporation tax rate now is 52 per cent on all income above $25,000 with an excess-profits tax taking 30 per cent of earnings in excess of 83 per cent of the base period, which works out at something like 70 per cent on all corporation income, and there is no prospect of these levies being reduced in the foreseeable future.

Help Wanted!

The House small-business committee wants to know just where every ton of steel allocated the oil industry went and to that end has asked the Petroleum Administration for Defense, through Interior Secretary Oscar L. Chapman, to give every detail of every allotment of oil-country tubular goods to every petroleum producer.

Planning to open hearings on the matter sometime next month, Committee Chairman Wright Patman of Texas is demanding full information on the requests for and allocations of tubular goods, wells drilled, total footage drilled, and total tonnage used for each of the more than 3,000 operators with whom PAD has dealt.

point out that they, as well as the producers, have incurred substantial increases in operating costs since present ceiling prices were imposed and warn that an increase in the cost of crude without a compensating increase in product prices would impose too great a burden for the refining industry to carry since current refining profits are no higher than they were in the base period.

Scrap-Drive Speedup Urged

WASHINGTON.—Refiners, natural-gasoline manufacturers, and producing companies are being asked by the Petroleum Administration for Defense to step up their scrap-collection programs.

In letters to the operators, Deputy Administrator Bruce K. Brown declared the situation is "critical" with an average supply of scrap at all steel mills now standing at less than 20 days as compared with a minimum safe working level of 60 days.

"At times," Brown said, "some steel mills have only 1 to 5 days' supply and often the proper type of scrap is not available, thus causing a slowdown in production. To make this situation even worse, new steel capacity is coming into production where initial stocks of scrap must be built up, if any finished production is to be obtained."

Some oil companies have already started well-organized scrap drives, Brown said. One such campaign has been undertaken by Sun Oil Co. which already has netted in excess of 8,500 tons with more still coming in.

Carbon-Steel Exports Set

WASHINGTON.—An export quota of 150,000 tons of carbon steel for foreign petroleum operations has been established for the first quarter of 1952 by the Office of International Trade.

Representing an increase of 5,900 tons over the quota for the fourth quarter of 1951, the steel available for foreign operators during the coming 3 months will include 45,560 tons of plate (of which up to 32,000 tons may be for welded pipe 16 or more inches in diameter), 6,100 tons of structurals, 40,000 tons of oil-country tubular goods, and 58,340 tons of carbon steel.

In addition to carbon steel, the OIT has authorized the export of 12,000 tons of alloy steel, of which 6,750 tons would be in the form of oil-country tubular goods, and 16,000 tons of tinplate.

Other metal allocations made for foreign petroleum operations included 750,000 lb. of brass-mill products, 1,373,000 lb. of wire-mill products, 14,000 lb. of foundry products, and 66,000 lb. of aluminum.

New Crude Line

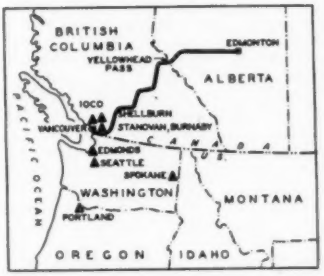
Construction on Trans Mountain's 75,000-bbl., 693-mile 24-in. line to be started next spring; all contracts let

EDMONTON. — Work on Canada's first crude-oil pipe line between Alberta and the Pacific Coast will begin as soon as weather permits next spring.

The 24-in. line will be 693 miles long, will operate with two pump stations, and will have an initial capacity of 75,000 bbl. per day. Erection of additional pump stations will permit an ultimate capacity of 200,000 bbl. per day.

Contracts for construction have been let by the builder, Trans Mountain Oil Pipe Line Co., to Mannix, Ltd., and Comstock Midwestern, Ltd. Mannix will lay 221 miles in the center of the line and Comstock Midwestern will construct the eastern and western segments totaling 472 miles.

Van W. Rosendahl, president of Canadian Bechtel, Ltd., which is designing the line and which will supervise its construction, said contracts for pump stations and tank farms will be awarded at a later date.



ROUTE.—Map showing route of Trans Mountain's crude line.

Significance. — Initial capacity of the line will be more than double the total capacity of existing refineries in British Columbia.

This province now has three refineries with a total crude-charging capacity of 28,850 bbl. per day. One is the 12,000-bbl. refinery of Imperial Oil, Ltd., at Ioco; another is the 8,500-bbl. plant of Shell Oil Co. of Canada, Ltd., at Vancouver; and the third is the 8,350-bbl. plant of Standard Oil Co. of British Columbia, Ltd., at Burnaby.

Operation of the new line at even half capacity would provide crude for additional refining capacity in the Pacific Northwest of 75,000 bbl. per day. Full-capacity operation would satisfy requirements of 175,000 bbl. of new refining capacity if none of the crude were shipped by tanker to existing refineries in the United States.

Refining of the crude in the Puget Sound area has been recommended in some quarters to reduce the need for tanker shipments of products from California to the Puget Sound area on the ground that these shipments could be interrupted easily during an emergency.

The line also will increase greatly the market for Canadian crude, presumably encouraging even greater effort to develop the country's petroleum reserves.

Alberta availability.—Production from Alberta's oil fields at present is considerably below their maximum efficient producing rate, due to lack of sufficient outlets.

During the week ended December 22, production averaged 134,000 bbl. per day, while during the peak summer months the weekly figure went as high as 183,000 bbl. per day.

The foreign-petroleum branch of the Petroleum Administration for Defense has estimated Alberta's present recoverable reserves at 1,506,400,000 bbl. Considering the MER to be 7.2 per cent of recoverable reserves, Alberta's present MER is close to 300,000 bbl. per day.

Local demand for Alberta crude in 1952 has been estimated by the Canadian Department of Trade and Commerce at about 100,000 bbl. per day, with an additional pipe-line demand of about 75,000 bbl. per day. With an estimated MER of about 300,000 bbl. per day, these figures indicate a surplus availability of Alberta crude of 125,000 bbl. per day.

The current rate of exploration and development is expected to add at least 30,000 bbl. daily to this "surplus availability" during the next several years, and most of this presumably would be available for movement to the West Coast.

The builders. — Trans Mountain Oil Pipe Line Co. is owned by Canadian Gulf Oil Co., Imperial Oil, Ltd., Shell Oil Co. of Canada, Standard Oil Co. of British Columbia (affiliate of Standard Oil Co. of California), Union Oil Co. of Canada, Richfield Oil Corp., and 14 independent oil producers.

Comstock Midwestern, Ltd., which will lay two-thirds of the line, is a new company formed by Midwestern Constructors, Inc., Tulsa pipe-line contractor, and Canadian Comstock, Ltd., an electric heating and plumbing-contracting firm of Leaside, Ont.

Officers of the company are F. E. Stanley, board chairman; C. C. Rathgeb, president; C. C. Bledsoe and C. I. Rathgeb, vice presidents; and William Baldwin, secretary - treasurer. This company is now building the 200-mile Sarnia-Toronto products line for Imperial Oil.

Headquarters of Mannix, Ltd., which will lay the center third of the line, are in Calgary, Alta. Stringing operations will be handled by Parkhill Truck Co.

Construction plans.—Construction of the $80,000,000 line is scheduled for completion in 1953.

Comstock Midwestern will put a minimum of three spreads on the job in 1952, under supervision of M. T. Wilhite. Clearing of the right-of-way is scheduled to begin in February, with pipe laying to commence about June 1. One spread will start from Vancouver. Two spreads will begin work at Jasper, Alta., near Yellowhead Pass, one working east and the other west.

The line's route is largely through wilderness country where distance between towns sometimes exceeds 100 miles. Trees 5 to 6 ft. in diameter and 12-ft. stumps are common.

Comstock Midwestern plans to operate with portable camps using railroad cars where feasible and trailers in other places. With the exception of superintendents, foremen, and skilled operators, construction will be done largely by Canadian labor.

All of the line will be buried and protected by coating with a single wrap of glass mat and asbestos felt.

Heating Oil, Diesel Fuel Up

TORONTO.—Imperial Oil, Ltd., has announced increases in tank-wagon prices of heating oils and diesel fuels on the prairies, effective as of December 17.

In Alberta the price at Edmonton is raised 1½ cents and at Calgary 2 cents. In Saskatchewan the Regina price is increased by 1½ cents, and in Manitoba the Winnipeg price is advanced ½ cent.

Polythene Plant Planned

MONTREAL.—Canadian Industries, Ltd., will construct the first plant in Canada here for the manufacture of polythene, at a cost of around $13,000,000. Work will commence next spring with completion scheduled for late 1953.

Manufacturing operations will utilize some 10,000,000 cu. ft. of natural gas daily, with 8,000,000 gal. of water and 35,000 k.w.h. of electricity. The raw polythene will be used in a polythene products plant at Shawinigan Falls, Que., replacing the imported product.

Stocks Cause Concern

Unusually high level causes Texas Railroad Commission to trim January crude-oil allowable by 86,825 bbl. daily

AUSTIN. — A sharp reduction in stocks of crude oil and some increase in Texas' reserve producing capacity are in prospect from the action of the Texas Railroad Commission in setting production allowables at 2,895,180 bbl. daily, a reduction of 86,825 bbl. daily below the mid-December rate.

In cutting output to 22 producing days, state wide, the commission went against the recommendations of most of the operators, who feared that there will not be sufficient crude to meet demands of Texas refiners. East Texas field remains on a 19-day schedule, and special field situations resulted in 14 producing days for Pantex, 10 for Picton, and 16 for Hawkins.

Stocks cause concern.—The commission's concern over the present high level of crude inventories was evident at the hearing last week.

Ernest O. Thompson, commission member, reported stocks of 259,085,000 bbl., and the Bureau of Mines' estimate of demand at 2,810,000 bbl. daily. The bureau, he said, did not specify whether the crude should come out of storage or from new production, but it is a matter for the state regulatory bodies to decide.

Thompson, reminding the group that at the October 1950 hearing it was brought out 260,000,000 bbl. of crude storage is needed, said that the commission needed some new testimony from heads of the oil companies as to the "new conditions as of now."

It would seem, he said, that now is the time to adjust stocks down to the testimony or that the industry should promptly bring the commission—perhaps at the January meeting—new testimony upon which to act. The commission has set the next allowable hearing for 9 a.m. January 16 at the Commodore Perry Hotel in Austin.

Producing reserve. — Thompson, who earlier had stated that what the country should do first is to build up its national crude-oil daily reserve-producing ability, said that the United States has only 510,000 bbl. daily producing reserve "at the most optimistic figure. It is probably more correctly 500,000 bbl. daily. We need more wells drilled to build this daily reserve ability to produce."

Operators' nominations.—Humble Oil & Refining Co. asked for 24 producing days statewide, 19 for East Texas field, and 16 days for Hawkins field.

"The accumulation of crude-oil stocks a year ago," Herman Pressler, Humble representative, stated, "has been entirely in the Mid-Continent and Rocky Mountain area, whereas stocks of crude located in Districts 1 and 3, and in District 5 have actually decreased. The difficulties arising from this change in crude stocks by location are evident when these figures are related to the change in refinery crude runs.

"For Districts 1 and 3, refinery runs in the week of December 8 were 3,608,000 bbl. daily, an increase of 462,000 bbl. daily or 15 per cent over a year ago. The crude stocks located in this area have actually decreased. On the other hand," he said, "crude-oil stocks located in Districts 2 and 4 have increased by about 18 per cent."

Pressler said that Humble, in making its 24-19-16-day nomination, would draw on stocks at 30,000 bbl. daily during January and would be on the market for 10,000 bbl. daily of West Texas and 35,000 to 50,000 bbl. daily of Gulf Coast crude. Inquiries, however, indicate that the company will not be able to obtain any of this Gulf Coast crude, he said.

Other proposals.—Proponents of a 23-19-day schedule included Gulf Oil Corp., Shell Oil Co., Sinclair Oil & Gas Co., Magnolia Petroleum Co., The Texas Co., and Cities Service Oil Co. Magnolia reported it will withdraw 10,000 bbl. daily from stocks on the 23-19-day basis, and Cities Service said that it would still be short on Gulf Coast, and long on West Texas crude. Shell Oil Co. sought a 24-19 schedule.

Irving Fish, Texas City Refining Co., said his firm had lost 5,000 bbl. of crude a day that it had been expecting to get, which would make it 10,000 bbl. daily short during January, and 15,000 to 20,000 bbl. short thereafter.

East Texas. — H. P. Nichols read a statement to the commission from Jim McCurdy, of Fort Worth, president of East Texas Oil Association, advocating a lowering of allowables to a point slightly below demand, and maintaining the level there until stocks and products are in a more economical position. He advocated a cut of 2 days statewide and 1 day in East Texas, or even more if necessary.

The East Texas pressure showed a decline of 0.47 psi. from the November 1 figure of 1,019.36 to 1,018.89 psi. December 1. Daily average allowables during November were 279,786 bbl., and salt-water injection averaged 402,511 bbl. daily, an increase of 3,441 bbl. over October.

Dissension.—J. A. Neath of Humble produced stock figures on products in an effort to show that increases of products in storage are about in line with higher demands. He said that the commission should consider the recent cold weather in the North and East in combination with increased products demands this year and an expected 5 per cent boost in demand through 1952.

E. I. Thompson of the Texas Independent Producers and Royalty Owners Association warned about the suggestion that had been made for a long-range commission policy of cutting allowables below demand and holding them there. Imports are no problem just now, he said, but if such a policy were adopted, importers would increase imports accordingly.

ALLOWABLES, BY DISTRICTS
(Barrels daily)

	December 15	January
Dist. 1 (Southwest)	36,621	36,113
Dist. 2 (Southwest)	168,493	161,742
Dist. 3 (Gulf Coast)	494,849	479,915
Dist. 4 (Southwest)	266,236	257,226
Dist. 5 (Eastern)	56,078	54,227
Dist. 6 (outside E. Tex. field)	127,796	125,050
Dist. 6 (E. Tex. field)	271,241	271,241
Dist. 7-B (Central)	106,051	103,208
Dist. 7-C (West)	127,656	123,272
Dist. 8 (West)	1,028,353	988,836
Dist. 9 (N. Central)	198,847	194,573
Dist. 10 (Panhandle)	99,784	99,777
Total	2,982,005	2,895,180

Scurry Unitization Nears

Final-agreement papers for unitized pressure-maintenance operation of more than 1,400 oil wells in Kelly-Snyder and Diamond M fields in Scurry County, Texas, will be drawn up and ready for circulation early next month.

Dale R. Snow, vice president of Sunray Oil Corp. and chairman of the Scurry Area Canyon Reef Operators Committee, said last week that all controversial points have been ironed out by majority vote of the operators at a general meeting in Forth Worth. The legal committee is now preparing the final draft of the agreement.

As soon as the agreements are ready they will go to the operators for signature. The proposed operators of four major segments of the project will be made responsible for obtaining the signatures of royalty owners in the respective areas. This is expected to speed up the program considerably.

The agreement will become effective on signing by 75 per cent of the operators and 65 per cent of the royalty owners.

Unit operation of the fields will affect about 54,000 acres of productive oil leases.

Billion a Year

Texas to record crude, condensate output in excess of one billion barrels in 1951, a gain of 20 per cent over 1950

Walter Rose

HOUSTON. — Texas is expected to end 1951 with a record yearly production of crude and condensate of more than a billion barrels.

Breaking the billion-barrel mark would mean an increase in production of 20 per cent compared with output in 1950.

Based on production figures for the first 10 months of 1951 and estimates for the remainder of the year, it is expected that crude-oil output will total about 999,078,000 bbl. and condensate production will total another 14,000,000 bbl.

Previous all-time record in Texas was 1948's combined crude and condensate production of 903,498,000 bbl.

The 20 per cent increase over the level of 1950 operations was spread fairly evenly over the leading producing companies. The accompanying table, which lists 18 companies which over recent years have produced about half of the state's crude oil, shows that the companies individually had increases approximating 20 per cent over the previous year.

Company ranking.—Humble Oil & Refining Co. again leads Texas producers, showing a 1951 production greater than the combined output of second-ranking Stanolind Oil & Gas Co. and third-place Gulf Oil Corp.

While relative positions of the companies remained virtually unchanged from last year, a look at the standings in 1945 shows some significant changes.

Magnolia Petroleum Co., for example, increased its production sufficiently to swap The Texas Co. out of fourth place. Both Phillips Petroleum Co., which remained No. 8, and Pure Oil Co., which jumped from No. 15 to No. 13, showed gains of more than 60 per cent during the 6-year period.

Standard Oil Co. of Texas showed a production increase since 1945 of 158 per cent to move from eighteenth to fourteenth place.

On the other hand, companies like Ohio Oil Co. and Amerada Petroleum Corp. dropped in rank despite production increases of more than 30 per cent.

What it means. — The billion-barrel production figure for 1951 is equal to 7 per cent of the cumulative total of all oil produced in Texas since 1894, when the state's first commercial oil field, Corsicana, was brought in.

The figure also is almost equal to the annual production of all other states combined in recent years.

Condensate. — Humble, Phillips, and Skelly Oil Co. remained the state's leaders in condensate production during 1951.

Combined production of the three was more than a fourth of the state's total condensate production.

Humble led all other companies in a picture virtually unchanged from 1950, although in that year Phillips was the leader by a small margin.

1951 rank	Company—	Crude production Thousands of bbl. dly. 1951*	1950	1949	% inc. 1951 over 1945	1945 rank	Condensate† 1951*	1950
1	Humble Oil & Refining Co.	324.0	261.7	260.4	9	1	4,500	3,645
2	Stanolind Oil & Gas Co.	170.0	140.7	134.7	31	2	1,140	956
3	Gulf Oil Corp.	147.0	124.2	120.5	14	3	1,615	1,067
4	Magnolia Petroleum Co.	127.0	99.2	81.7	41	5	750	782
5	The Texas Co.	118.0	99.1	88.4	31	4	1,550	982
6	Sun Oil Co.	84.2	65.8	61.8	36	6	848	1,058
7	Shell Oil Co.	84.0	72.9	73.7	36	7	700	820
8	Phillips Petroleum Co.	75.7	59.0	58.1	61	8	3,100	3,802
9	Atlantic Refining Co.	65.0	54.0	50.5	30	9	888	454
10	Continental Oil Co.	51.8	43.5	40.8	44	11	493	227
11	Tide Water Associated	44.5	39.8	36.7	9	10	753	518
12	Sinclair Oil & Gas Co.	40.3	32.9	32.4	19	12	1,255	924
13	Pure Oil Co.	40.0	32.2	28.7	62	15	201	4
14	Standard Oil Co. of Texas	38.5	32.7	21.9	158	18	165	180
15	Ohio Oil Co.	36.9	30.0	32.4	41	13	640	183
16	Amerada Petroleum Corp.	34.2	27.3	27.6	31	14	49	55
17	Cities Service and Arkansas Fuel	31.4	28.9	30.8	44	16	148	115
18	Skelly Oil Co.	26.0	21.4	19.6	33	17	2,410	2,463

*Including preliminary figures for November and December. †Barrels daily production.

Louisiana Boosts Allowable

BATON ROUGE. — The crude-oil-production allowable for Louisiana has been set by the conservation commission at 647,359 bbl. daily for January, an increase of 10,476 bbl. daily over the December production of 636,883 bbl. daily.

The raise is the first since the commission started trimming the allowable last October, following through in November and December.

S. L. Digby, commissioner, estimated that total crude-oil output for the state under the January allowable would be 613,359 bbl. daily, and production of liquid hydrocarbons other than crude oil would come to about 47,000 bbl. daily.

South Louisiana fields will be allowed a production of 532,846 bbl.

WEST COAST

Wilshire Interests Sold

LOS ANGELES.—Controlling stock in Wilshire Oil Co., Inc., has been acquired by B-L & Associates, Inc., a corporation formed by Blyth & Co., Inc., and Lehman Brothers.

All stock owned by the heirs of Alfred and Victor Machris was sold, but George L. Machris is retaining his stock interest in Wilshire.

Wilshire has been in operation since 1919, and its principal properties consist of oil-producing leases in Wilshire - Ellenburger field in Upton County, Texas; Scurry County, Texas; and in South Cuyama, Huntington Beach, and other fields in California; a refinery at Norwalk, Calif., with a daily capacity of 22,500 bbl.; related storage facilities, and pipe lines; and retail and wholesale-distribution facilities.

Industry Briefs

NORMAN, Okla.—First and Second Wilcox sand production was confirmed in Northwest Norman field of Cleveland County, Oklahoma, this week by Producers Development Co. 1 Neher, C NE SE 20-9n-3w. On a 9-minute drill-stem test made at 9,422-58 ft. in First Wilcox topped at 9,417 ft., and in Second Wilcox topped at 9,433 ft., the well sprayed oil and started unloading with production estimates up to 150 bbl. per hour. Recovery in drill pipe was 400 ft. of 38.5° gravity oil. Initial flow pressure was 2,900 psig. through a 5/8-in. top choke. Operators recovered 52 ft. of saturated sand in a core taken later from 9,458-9,510 ft.

DENVER.—A movement to place on the 1952 general-election ballot in Colorado a proposed state constitutional amendment imposing a 5 per cent severance tax on oil and natural gas produced in the state, with yield to be dedicated to support of public schools, has been launched by the Oil Severance Tax Committee of Colorado.

NEW YORK.—Sinclair Refining Co. has purchased marketing facilities of Crown Oil Co. in Wyoming, and will begin operating the properties January 1. P. C. Spencer, president of Sinclair Oil Corp., revealed here this week. The company has purchased more than $26,000,000 worth of oil in Wyoming since 1941, and has invested about $34,000,000. Spencer also announced that Sinclair Oil Corp. has registered with the Securities and Exchange Commission as a holding company under the Public Utility Holding Company Act.

REMOTE WILDCAT.—View of Petroleum Development (Trucial Coast, Ltd.'s) test at Jabal Ali in the Shiekdom of Dubai, 300 miles east of Qatar. This wildcat is the most remote well now being drilled in the Middle East.

Jabal Ali Venture

Petroleum Development's wildcat in Dubai, now below 8,000 ft., is Middle East's most remote drilling well

Dahl M. Duff

MOST remote wildcatting currently under way in the Middle East is Petroleum Development (Trucial Coast Ltd.'s) test at Jabal Ali in the Sheikdom of Dubai about 300 miles east of Qatar.

The well is now drilling below 8,043 ft. It was spudded May 26; 16-in. casing is set at 916 ft., and 11¾-in. at 4,036 ft. The well went through a 3,000-ft. salt section before reaching the present depth. Petroleum Development (Trucial Coast) is associated with Iraq Petroleum Co., Ltd.

The Jabal Ali well was commenced following the suspension of the Ras Sadr test in the nearby Sheikdom of of Abu Dhabi. Ras Sadr, 13 months in drilling, was taken to 13,001 ft. to become the second deepest test in the Persian Gulf (after Kuwait Oil Co.'s 13,853-ft. Burgan DT-2).

National rig.—A National 100 rig is being used at Jabal Ali. It is powered by Paxman diesels developing 400 hp. each at 1,200 r.p.m. Equipment, except fishing tools, bits, and a few specialty items from the United States was made in the United Kingdom. Another rig of the same type was used at Ras Sadr.

Twenty-five Europeans and Americans and 267 Arabs and Indians are employed at the field camp. Drillers are American. Fresh-water supply is from a sea-water distillation unit erected at the beach about ½ mile distant from the well.

DRILLING RIG.—The National 100 rig being used to drill the Jabal Ali test is powered by Paxman diesels developing 400 hp. each at 1,200 r.p.m. All equipment except fishing tools, bits, and specialty items was made in the United Kingdom.

The contract staff personnel are housed in a 28-room prefabricated Supralite (English-made) air-conditioned structure. Heavy supplies are brought in by lighter and former Navy landing craft at a point on the beach about 25 miles southwest of the location.

Seismic structure.—Both Ras Sadr and Jabal Ali are on gravity and seismograph prospects. Jabal Ali is being drilled on the shoreward side of a rise which marks the surface feature of the structure.

FAST TRANSPORTATION.—One of the eight-passenger DeHavilland Doves used by the International Petroleum Co., Ltd., organization (of which Petroleum Development is an associate) for moving personnel to and from its operations, including the Jabal Ali wildcat.

IN CHARGE.—Mack Bell, Long Beach, Calif., left, one of the American drillers on the Jabal Ali wildcat venture, and B. O. McDonald, tool pusher in charge of the project. Twenty-five Europeans and Americans and 267 Arabs and Indians are being employed at the field camp.

Oil Production Gains

Output throughout world averaged 11,893,800 bbl. daily in October, a gain of 135,000 bbl.; U. S., Kuwait Up

Dahl M. Duff

CRUDE-OIL production throughout the world averaged 11,893,800 bbl. daily during October, a gain of 135,000 bbl. daily over September. The United States and Kuwait accounted for nearly all the total increase.

The October figure compares with the all-time record of slightly over 12,000,000 bbl. daily in June, the last full month of production in Iran before the shutdown due to the nationalization dispute.

United States production in October averaged approximately 6,332,000 bbl. daily, a new high. Kuwait's output established another record in October with an average of 707,600 bbl. daily. Only small gains, and in some cases declines, were reported in other major world producing countries in October.

Middle East.—As a result of increased output in Kuwait, the Middle East as a whole showed an average of 1,810,300 bbl. daily, a 3.9 per cent gain over September but still considerably below last May's record for the area of 2,203,800 bbl. daily. The Middle East is not expected to recover the full Iranian loss until the middle of next year when the new 30 and 32-in. Kirkuk-Banias pipe line comes into operation.

Average monthly crude production in the Middle East during the first half of 1951 was 2,030,000 bbl. daily. Compared to this, the total October output represents a drop of only 220,000 bbl. daily. Before production was halted, the daily average in Iran by Anglo-Iranian Oil Co., Ltd., was running between 650,000 and 700,000 bbl. daily.

Average monthly production during the first half of 1951, of all foreign countries, excluding Russia and Communist eastern Europe, was 4,660,000 bbl. daily. In October, foreign less Communist production averaged 4,581,000 bbl. daily, indicating that all but about 80,000 bbl. of the Iranian loss was met during that month from sources outside the United States. Such a comparison, however, does not take into account the additional requirements caused by normal growth of petroleum demand.

Big gain.—The largest gain over first-half average production was shown in the United States. The October output of 6,332,000 bbl. daily compares to the first-half average production of 6,061,000 bbl. daily, or an increase of 271,000 bbl. daily.

Preliminary reports on Canadian production in October showed a drop of 12,000 bbl. daily from the previous month. This more than offset the 7,600 bbl. daily increase reported in Venezuela, and as a result total foreign production in the Western Hemisphere declined slightly. The only other change of significance was in Ecuador where revised reports indicated a production in excess of 8,000 bbl. daily, considerably more than previously reported for this country.

Venezuela.—The increase in Venezue-

WORLD CRUDE-OIL PRODUCTION
(In thousands of barrels daily)

Country—	Oct. 1951	Sept. 1951	Oct. 1950
Western Hemisphere:			
Argentina	72.0	73.0	67.5
Bolivia	1.5	1.5	1.7
Brazil	2.5	2.5	0.8
Canada	150.8	162.8	88.0
Chile	2.1	2.0	1.4
Colombia	106.2	105.5	98.6
Cuba	0.1	0.1	0.2
Ecuador	8.2	7.7	7.2
Mexico	213.0	214.0	205.6
Peru	44.5	44.5	42.2
Trinidad	57.7	57.5	57.1
Venezuela	1,732.8	1,725.2	1,611.5
Total	2,391.4	2,396.3	2,181.8
Europe and Africa:			
France	5.7	6.4	3.0
French Morocco	1.9	1.9	0.9
West Germany	28.9	28.6	22.9
Italy	0.4	0.4	0.2
Netherlands	13.3	13.4	12.4
Egypt	44.3	44.3	46.3
United Kingdom	0.9	0.9	0.9
Total	95.4	95.9	86.6
Middle East:			
Bahrein	30.2	30.1	29.8
Iran		3.3	625.3
Iraq	176.2	181.2	167.6
Kuwait	707.6	628.7	387.4
Qatar	48.0	51.0	39.2
Saudi Arabia	848.1	847.1	643.1
Turkey	0.2	0.3	0.3
Total	1,810.3	1,741.7	1,892.7
Other Asia:			
British Borneo	105.0	105.0	92.7
Burma	2.0	2.0	1.8
China	2.2	2.2	2.0
India	5.0	5.0	5.0
Indonesia	155.0	155.0	139.0
Japan	6.5	6.5	6.3
New Guinea	4.9	4.9	4.9
Pakistan	3.3	3.1	3.6
Total	283.9	283.7	255.3
Total foreign less Russia and E. Europe	4,581.0	4,517.6	4,416.4
Estimated Russia and Eastern Europe:			
Austria	41.0	41.0	30.0
Romania	85.0	85.0	85.0
Russia	825.0	825.0	775.0
Other E. Europe	29.8	29.8	24.6
Total	980.8	980.8	914.6
Total foreign	5,561.8	5,498.4	5,331.0
United States	6,332.0	6,260.5	5,899.9
World total	11,893.8	11,758.9	11,230.9

Figures are from reliable reports in the industry or official government sources. Data for Russia and Eastern Europe are based on competent estimates; no authentic information is available on month-to-month production in these areas. Complete current reports also are lacking for certain countries of Southeast Asia. Data for earlier months have been revised where necessary.

lan production was small but it represented another all-time record. During the first 10 months of the year, Venezuelan crude production increased in all but one. The gains have been for the most part relatively small.

October production in Colombia was divided as follows among the concessions: De Mares 36,765 bbl. daily; Barco, 29,128 bbl. daily; Yondo, 35,840 bbl. daily; Contagallo,-1,299 bbl. daily; Dificil, 1,762 bbl. daily; and Velasquez, 1,479 bbl. daily. An additional, 2,237 bbl. daily of condensate was produced by the government company from its De Mares properties.

Crude production in West Germany showed another slight increase, rising to 28,900 bbl. daily, or 126,546 tons. Production in the Emsland area was 55,875 tons, while that in the rest of Saxony was 60,415 tons. Production in the Hamburg and Schleswig-Holstein region was 9,728 tons, and 528 tons were produced in Baden.

VENEZUELAN PRODUCTION
(By companies)

	October	1950 average
Creole	778,088	685,839
Shell	536,767	461,607
Mene Grande	253,893	202,211
Socony-Vacuum	54,494	37,003
Texaco	23,322	25,711
Mercedes	24,159	18,706
Atlantic	18,341	20,944
Richmond	14,170	12,502
Sinclair	13,152	12,598
Pantepec	9,139	12,318
Phillips	6,392	7,492
B.C.O.	920	995

MIDDLE EAST

ABQAIQ SCENE.—Arabs utilize an outlet on Aramco's water line in Abqaiq field, near location of drilling rig.

New Life for Abqaiq

Aramco to spend $20,000,000 on pressure-maintenance project for this Arabian field, one of world's largest

Dahl M. Duff

A LARGE-SCALE pressure-maintenance program involving the return of more than 150,000,000 cu. ft. daily to Abqaiq reservoir in Saudi Arabia is being planned by Arabian American Oil Co.

Construction of the compressor plant and other facilities is scheduled to begin as soon as approval is obtained for the required materials. The final project, employing centrifugal compressors in the first stage and reciprocating units in the high-pressure stage, is due for completion in mid-1953. Total cost is approximately $20,000,000.

Abqaiq, regarded as one of the world's three largest oil fields along with East Texas and Kuwait's Burgan, is 32 miles long and on the average 6 miles in width. Production currently is approximately 550,000 bbl. daily. A total of 61 wells produce from the D member of the Arab zone from 6,000 to 6,500 ft. The discovery was made in November 1940 but most of the field development has come since the end of the war.

Studies made. — Studies of reservoir characteristics and performance have been made since the time the field was first produced. It was early realized that 8 to 10 per cent of the reservoir history was needed in order to determine the most appropriate recovery technique.

Material-balance and unsteady-state studies indicate an approximate water influx into the reservoir of 300,000 bbl. daily or about 200,000 bbl. daily of stock-tank oil considering the formation volume factor of 1.5. Production under this natural water-influx rate was not considered high enough for long-range operation in view of the size of the field's reserves.

Examination of reservoir data also indicated the existence of a common aquifer furnishing the water drive for Abqaiq, Ain Dar field 27 miles west of Abqaiq, and the newly discovered Uthmaniyah field about 42 miles south and east of Ain Dar. Recent studies have given evidence of pressure interference where the drop in Abqaiq reservoir pressure has caused a measurable drop in the pressure of the Ain Dar reservoir.

Favorable factors.—Among the factors favoring the institution of a gas-injection program was the fact that 20 of the producing wells are located on the 6,000-ft. contour. Gas injection is expected to delay the loss of these wells as oil producers.

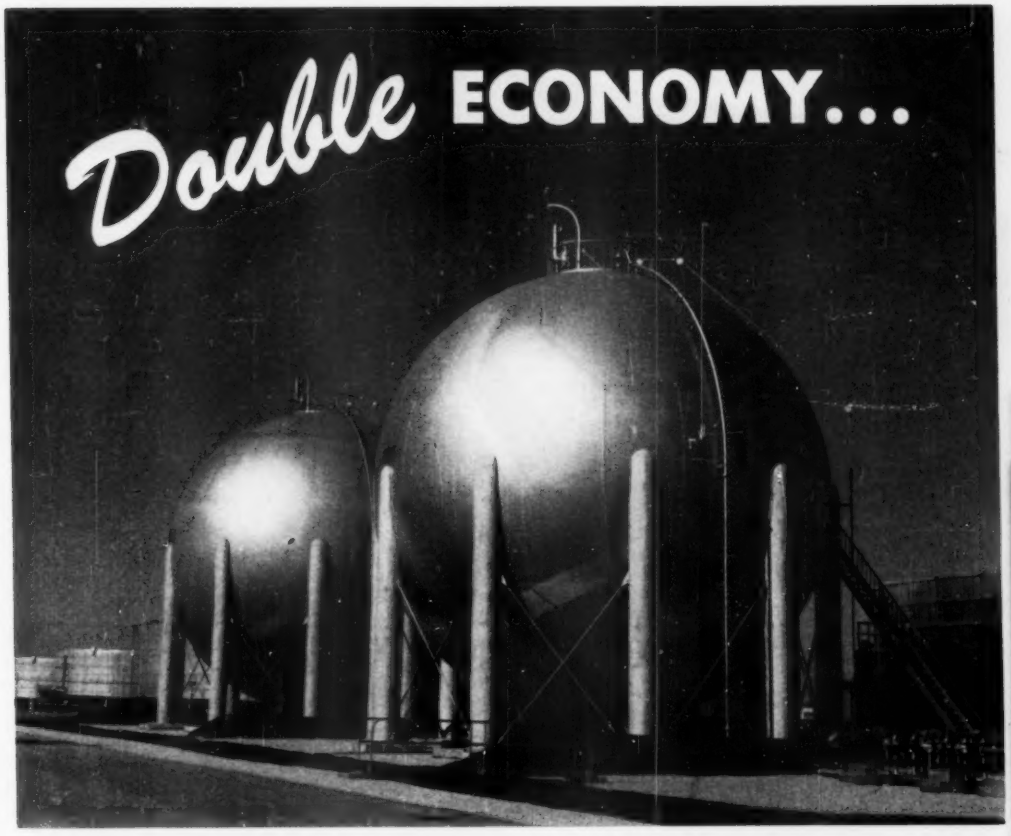
A close relationship between reservoir pressure and producible well potential has been noted in Abqaiq. The original productive potential of the Abqaiq wells ranged from 18,000 to 20,000 bbl. daily. Currently, potential of the individual wells is approximately 10,000 bbl. daily.

Pressure gradients in the field are generally uniform, and the field is considered to be in a satisfactory condition. The wells of the higher productivity index of from 300 to 500 are in the higher structural locations, while the downflank wells have an index in the 100-150 range.

The Abqaiq area to be affected by the pressure-maintenance program consists of the main anticlinal section to the south which comprises by far the most important part of the field. No additional wells are contemplated in this part of the field. A water-flood program, possibly in the north part of the field, is under continuing study and may be undertaken later if conditions warrant.

Injection well.—Abqaiq No. 50, the highest structurally in the field, has been chosen for the initial gas injection. This well was shut in in 1950 and used for observation purposes because of its increasing GOR. It is located at —5,600 ft. subsea. A second well, No. 6, about 2 miles southwest of No. 50, will be used for injection later.

Well No. 50 is considered particularly adapted to the initial injection. During drilling, it had lost circulation indicating a particularly fissured for-



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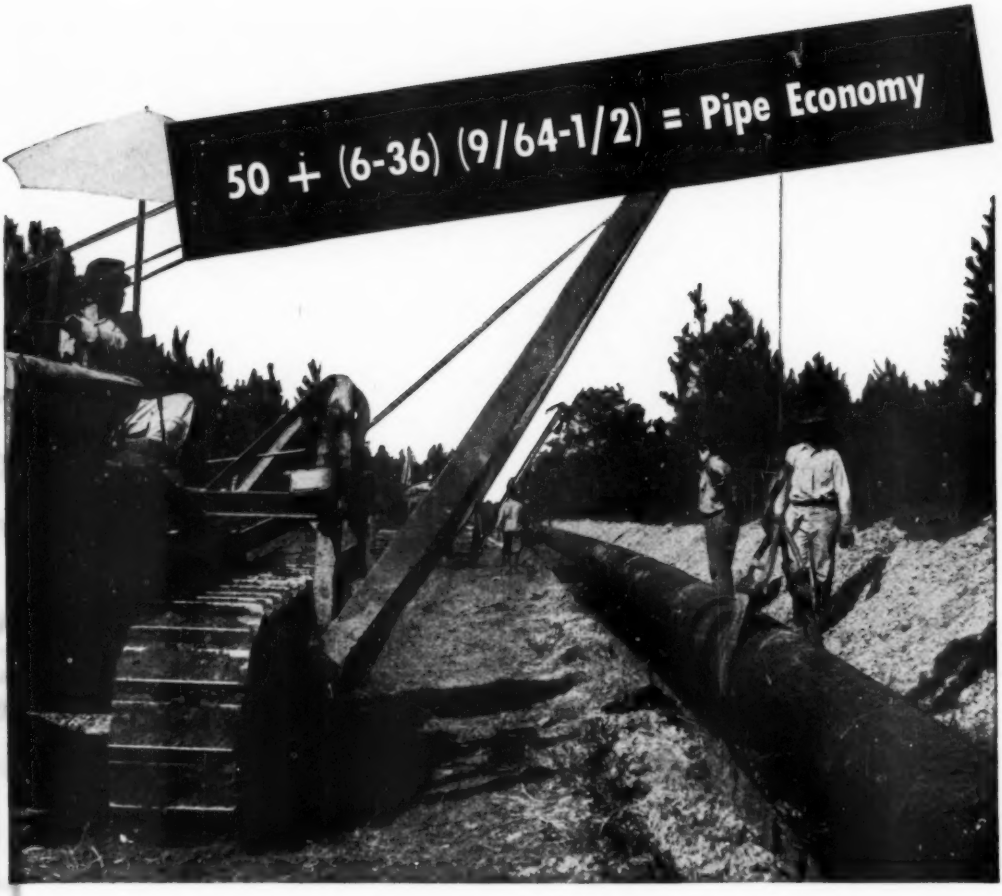

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mation. It is felt that reservoir gas has been migrating to this point, and that a down-the-flank migration of oil is taking place. This part of the program is planned to take advantage of gravitational drainage.

Gas supply.—The compressor plant and auxiliary facilities are proposed for construction near the Abqaiq main plant area which is located close to the center of the south end of the field. The gas to be used in the injection program consists of the high-pressure 500-psi. gas from the first stage of separation. This gas will be taken from all three Abqaiq gas-oil separator plants, No. 1 in the main Abqaiq plant area, as well as Nos. 2 and 3 which are located near the center and the north end of the field respectively. Gas will be brought to the compressor station through 10½ miles of 6-in. and 6½ miles of 8-in. pipe line.

Separator Stations 1 and 2 have a nominal capacity of 200,000 bbl. daily each, while No. 3 is rated to handle 100,000 bbl. daily. From these stations, 150,000,000 to 170,000,000 cu. ft. daily of first-stage 500 psi. gas will be moved to the injection compressor plant. The 500 psi. at the separators allows the gas to be transferred to the injection plant without further compression.

Plans provide for receiving the gas at the compressor plant at about 430 psi. and raising it to approximately 3,000 psi. on the discharge side. The injection-well lines will be 8-in.

Compressors.—The centrifugal compressor equipment consists of four Clark units, to be used two in series and two in parallel when the injection program goes into operation.

The centrifugal compressors, steam-turbine driven, will provide the first two stages of compression from 430 to 650 psi. and from 635 to 1,035 psi. at normal operating load of 2,522 hp. at 9,000 r.p.m. The reciprocating units are capable of compressing 168,400,000 cu. ft. daily in the third, high-pressure stage from 1,020 to 3,000 psi. They are Clark, 4-cyclinder, 300-r.p.m., 2,500-hp. units, electric-motor driven.

This arrangement was decided on in view of the lack of experience in operation of centrifugal compressors at such high pressures as in the final stage. Furthermore, it was found impractical to design a centrifugal compressor for the final compression stage which would be small enough to take less than the full gas load in one unit. The centrifugal units were considered desirable for the lower stages of compression, particularly from the standpoint of avoiding difficult maintenance. This latter aspect is of prime importance in selecting equipment for use in Saudi Arabia.

Scrubbers.—Gas received from the separator stations will be sent through first-stage scrubbers to remove condensate and entrained liquids. Other scrubbers similarly equipped with mist extractors will be used between each of the three stages of compression.

Before entering the first stage of compression, incoming gas will pass through dehydrating columns. These will be used alternatively to allow regeneration of the Sovabead desiccant on an 8-hour cycle for operation and regeneration. Sufficient water will be removed from the heavily saturated gas to prevent slugging in the compressors and hydrate formation. With this amount of water removal, corrosion will be held at a minimum, even with 1½ per cent of H_2S and 8 to 10 per cent of CO_2.

The desiccant will be regenerated by taking about 4 per cent of the main gas stream, heating in a steam exchanger and passing through the exhausted beds. The gas will then go through a cooler, water separator, and finally return to the main stream.

Injection capacity.—The injection facilities will have the capacity in gathering lines, vessels, and in the centrifugal compressors to accommodate 40,000,000 cu. ft. daily of additional gas above the 150,000,000 cu. ft. daily planned initially. Although the gas is not particularly rich in C_3s plus, studies are being made of the possibility of construction of a gasoline extraction plant.

Power from two 10,000-kw. turbines is now available at Abqaiq. Construction of the injection facilities will call for the installation of three more 220,000 lb. per hour boilers and one additional 10,000-kw. turbine. Steam generated will be used to drive the turbines required for the centrifugal compressors and electric-power generation. Gas fuel for the boilers will be taken from lower stages at the gas-oil separator plant.

Use of the high-pressure separator gas for injection will necessitate changing the present gas-expansion turbines powering pumping facilities at the separator stations. Electric motors will be installed at Separator Stations 2 and 3, while steam turbines will be used at Station 1.

Buyers Warned

Oil deals with Iran may bring action by A.I.O.C.

IN a new set of advertisements in the world's press, Anglo-Iranian Oil Co., Ltd., has again warned of possible legal action against any purchasers of oil from its seized properties in Iran.

The company's announcement was brought on by the renewed efforts of the Iranian Government to sell production of its now-nationalized industry. More than 10,000,000 bbl. of products are still in storage at Abadan, and nothing has been exported since late June.

Anglo-Iranian's statement said that the company "is confident that no oil company of repute or any tanker owners or any brokers of standing will countenance any direct or indirect participation in the unlawful actions of the Iranian Government."

If, however, any individuals or concerns enter into transactions with the Iranian Government for the products concerned, the company warned it would take "all such action as may be necessary to protect its rights in any country."

Legally right.—Outside Iran, Anglo-Iranian's legal position in the nationalization dispute is considered almost unassailable. If a tanker loads any of the products now at Abadan, the company would assert its claim in the country of destination.

The threat of legal action has undoubtedly been a deterrent to purchases of Iranian oil by the so-called fringe buyers in the industry. Another factor is the tight tanker market, now at 200 per cent or more over U.S.M.C. scale.

Apparently the most likely buyers are the Communist countries of eastern Europe in whose courts Anglo-Iranian could not expect much of a hearing. Iran has been trying to sell oil to Poland and Yugoslavia. Russia itself has shown no interest in buying Iranian oil, according to Hussein Fatemi, the former Iranian deputy prime minister.

Elections under way.—Elections were under way in Iran last week amid continued political turmoil. A group of deputies remained in the Parliament building where they had sought sanctuary from whom they claimed where terrorists of Prime Minister Mossadegh. It was generally anticipated that Dr. Mossadegh's government would win the current elections.

The growing financial troubles of Iran were reflected in an announcement of the government in Teheran that 26 Iranian diplomats throughout the world were being recalled because of the shortage of foreign exchange. Included were the ambassadors to Britain, Italy, and India.

The parliament was deadlocked without a quorum, and its failure to adopt the monthly finance bill caused the army and the country's civil servants to go without pay.

The Iranian Government appeared willing to accept assistance from the International Bank for Reconstruction and Development, but stipulated that it continue in control of the properties. The Iranian plan was that the bank provide help to obtain 200 foreign technicians (no British included) and boost production to 600,000 bbl. daily or more.

The bank earlier announced it was studying the possibility of interim operation of the industry and its officials have been conferring with the British Foreign Office.

Iraq Takes Over

Government will operate two A.I.O.C. subsidiaries

THE Iraqi Government announced this week in Baghdad that it was taking over the properties of two small refineries and marketing companies. Both subsidiaries of Anglo-Iranian Oil Co., Ltd.

The step was called a nationalization in Baghdad, but it appeared to be more of an agreed purchase of the companies by the Iraqi Government.

Involved were Khanaqin Oil Co., Ltd., and Rafadain Oil Co., Ltd. Khanaqin Oil operates an 8,000-bbl. daily distillation plant in East Central Iraq drawing crude from the Iraqi side of Naft-I-Shah field which is productive on both sides of the Iraqi-Iranian border. Rafadain Oil handles distribution and marketing in Iraq.

The Iraqi Government's announcement said the companies would continue their operations on behalf of the government, until they had trained sufficient Iraqis to take over the properties. The government said it had instructed its economics minister to sign an agreement for government acquisition of the companies. Compensation, it is understood, will be paid by the government.

New concession. — Behind the move are the concession - revision agreements negotiated last summer by Iraq Petroleum Co., Ltd., and the Iraqi Government and which are to be submitted to the Iraqi Parliament sometime the early part of next year. Anglo-Iranian owns a 23.75 per cent interest in I.P.C.

As a part of the agreement, the Iraqi Government will receive a supply of crude oil from I.P.C. at about 10 cents a barrel and has awarded contract for a 25,000-bbl. daily refinery near Baghdad to supply the internal needs of the country. This crude-supply arrangement was a right given Iraq in the old I.P.C. agreement but not previously exercised.

Anglo-Iranian thus met Iraqi requirements, but the prospective entrance of the government into the domestic refining and marketing field leaves little place for continuing these private distribution operations.

Burgan Field Extension

Kuwait Oil Co., Ltd.'s, Magwa discovery 7 miles north of Burgan field, is reported in the industry to be a major extension of this world's largest oil field. The company spudded in the well in August and encountered the regular Burgan sand series early in October. While no details on the well have been released, reliable reports are that it indicates a substantial enlargement of Burgan's 60,000-acre areal extent.

Crude from the Magwa well is said to be somewhat lighter than the 30-32½°-gravity oil produced in the main section of the field.

Magwa was the first exploratory well drilled by the company outside Burgan itself since the original field discovery. Burgan's reserves have been considered to be approximately 15 billion barrels.

LATIN AMERICA

Venezuela, Oil Firms Agree

The Venezuelan Government and the several larger oil companies operating in the country have come to terms on the formula for the calculation of the price at which the companies buy back the government's royalty share of heavy-crude production.

A government announcement in Caracas said the companies had accepted the basic formula proposed by the government. Companies involved include Creole Petroleum Corp., Mene Grande Oil Co., Shell, Texas Petroleum Co., and Richmond Exploration Co.

The agreement on the formula settled a matter at issue between the government and the company for several years. The companies had sought to have the royalty price based in some part on the price of residual fuel oil in the United States.

While the matter was undecided, the companies paid the minimum provided in the hydrocarbons law. Funds accumulated in excess of the minimum have now been paid to the government. This amounted to approximately $250,000,000 which was turned over to the government in three payments in 1951.

EUROPE

Goal Reached

U.K. refinery output to exceed expansion schedule

REFINERIES in Great Britain already have reached the expansion goal originally set for 1952-53, and still another 80,000 bbl. daily or more in capacity is scheduled to be added during the next 2 years.

Cause of this stepped-up program is principally the Iranian nationalization. Work now under way or definitely planned is expected to bring total capacity of U.K. refineries to 25,655,000 tons, or about 515,000 bbl. daily, by the end of 1953.

The original target by the oil committee of the Organization for European Economic Cooperation was 19,350,000 tons capacity by the end of the Marshall plan in 1952-53. Early this year, the committee revised its estimates and placed prospective U.K. refining capacity by 1952-53 at 21,330,000 tons.

Higher capacity.—Now it appears that total capacity by the end of 1953 will be 4,000,000 tons higher than the latest OEEC estimate. By the end of next year, total capacity will be about 3,000,000 tons above the revised figure.

Data of the Petroleum Information Bureau in London shows throughput of U.K. refineries is now about 20,805,000 tons, comprising 6,430,000 tons, Anglo-Iranian Oil Co., Ltd.; 8,500,000 tons, Shell; 5,500,000 tons, Esso Petroleum Co., Ltd. (Jersey Standard); and 375,000 tons, other companies.

Kent refinery.—Anglo-Iranian's Kent refinery will add 2,000,000 tons to the total next June, and a further 1,000,000 tons later in the year. Vacuum Oil Co.'s Coryton refinery of 850,000 tons is expected to be in operation by the end of the year. These developments will give a total U.K. capacity of 24,655,000 tons by the end of 1952. In 1953, Esso Petroleum's Fawley refinery is scheduled to add another 1,000,000 tons to its throughput, bringing the U.K. total to 25,655,000 tons.

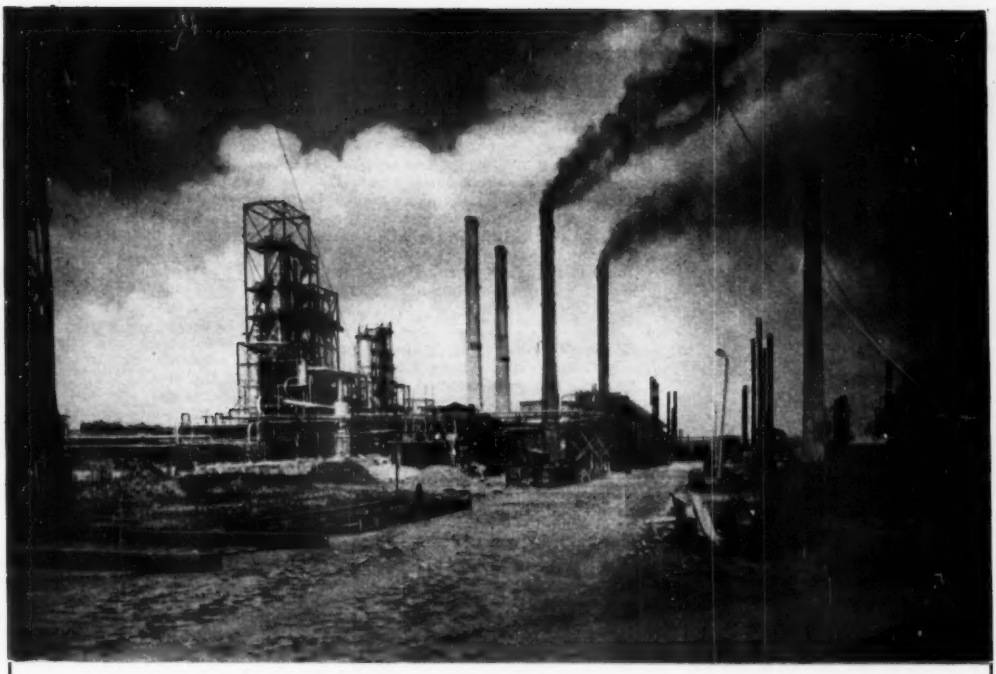
Figures on petroleum exports from the U.K. reflect the increase in refining capacity. During the first 10 months of 1951, exports of products were valued at £23,000,000, or more than double the amount reported during the same period of 1950. The exports were chiefly fuel oil and lubricants.

International Briefs

High-pressure dry-gas shows have been tested in the Patharia Hills wildcat of Pakistan Petroleum, Ltd., in East Pakistan. The well is now approaching final depth below 5,000 ft. Further testing is planned, but no commercial oil has yet been indicated. The well was spudded March 13.

Petroleos Mexicanos has announced plans to spend the equivalent of $2,900,000 next year to modernize its refinery at Tampico and Minatitlan. The program will involve the installation of sulfur-extraction facilities at each refinery. Capacity of the Tampico refinery is 47,000 bbl. daily, at Minatitlan 26,000 bbl. daily.

Construction work has been started on the Bogota terminal of the products pipe line being laid from Porto Salgar on the Magdalena River to the Colombian capital. The terminal and the line are being built by Williams Brothers. The 87-mile, 6⅝-in. line will relieve Bogota's dependence on rail shipments for its products supply. Another line from Porto Salgar to Cantimplora, where it would connect with an existing line to the Barrancabermeja refinery, is under consideration.



They had a problem... When World-War-Number-Two laid waste many of the largest Oil Refineries in Europe, it also left the world pitiably short of new or replacement plant. In fact Global disruption was complete. Oil Companies were hard put to know where to turn for supplies of more and yet more refining plant. Their normal sources of supply — although working at fever pitch, were still saturated with orders that would take years to complete. But the need for plant was urgent. The Royal Dutch Shell Group solved their problem, in part, when they turned to Harveys. For Harveys have one of the most modern and fully equipped works in the world for the fabrication of all kinds of heavy and light plant for the Oil and many other Industries. *In fact Yours the problem – Harveys the answer!*

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PERSONALS

Takes New Post

Wasson becomes advisor to Pure Oil executives

THERON WASSON, one of the most widely known geologists of the petroleum industry, will become senior geologist and advisor to the executive committee of Pure Oil Co., Chicago, January 1.

Wasson did survey work in New Jersey and California and with the U. S. Geological Survey topographic branch following his graduation from Carnegie Institute of Technology. After 2 years of graduate work at Columbia University he became connected with American Oil Engineering Corp., Fort Worth, and later with Leonard Exploration Co. in Ecuador. During World War I he served as an officer in France and Germany with the U. S. Army Corps of Engineers.

Wasson joined Pure Oil as chief geologist in 1922 and has continued in that capacity since that time. He has been connected with major field discoveries over a period of 30 years in Venezuela, Michigan, southern Illinois, Oklahoma, Texas, and the Rocky Mountains.

Among the Wasson publications is the "Mineral Book and Map of Europe." In 1949 he was a delegate to the United Nations scientific conference on conservation and utilization of resources, and last year was visiting geological advisor, Naval Petroleum Reserve No. 4, Point Barrow, Alaska.

Wasson is affiliated with a number of professional societies. Last October he received the Award of Merit "in recognition of his achievements in the field of petroleum geology" from Carnegie Alumni Foundation.

Donald M. Davis, exploration manager in Pure Oil Co.'s Gulf Coast producing division at Houston, and **Karl A. Mygdal,** chief of development geological section at Chicago, will both assume **Theron Wasson's** duties as chief geologist. Wasson has been named senior geologist and adviser to the executive committee. Davis will soon complete 25 years service with the firm and Mygdal 14 years. Both were recently appointed assistants to the exploration manager.

F. O. Koontz, sales manager of Quaker State Oil Refining Corp., Oil City, Pa., has been elected a director of the company, succeeding the late T. B. Gregory. **Lee R. Foraker,** formerly assistant secretary, was elected secretary and assistant treasurer, and **C. G. Johnson,** treasurer, was elected to the post of assistant secretary.

Lewis E. Hoffman has been appointed chief of a newly created Bureau of Land Management division of minerals. Hoffman, an authority on oil and gas leasing, joined the General Land Office, a predecessor agency of the Bureau of Land Management, in 1914. From 1920 to 1933 he engaged in private law practice, returning to GLO in November 1933. With the consolidation of GLO and the Grazing Service into the Bureau of Land Management in 1946, Hoffman became chief of the branch of minerals within the division of adjudication.

John M. Thomas, manager of the pipe-line division for H. C. Price Co., Bartlesville, Okla., has been named a vice president. **Elmer L. Gallery,** formerly secretary-treasurer, has been advanced to the position of vice president and treasurer, and **John P. Overton,** assistant treasurer, has been promoted to secretary of the company. Thomas has been with the firm since 1937, and Gallery and Overton joined the organization in 1946.

A. E. Bradshaw, Tulsa, has been elected chairman of the board of Oklahoma Natural Gas Co. Others elected were: **Joseph Bowes,** president; **F. W. Peters,** vice president, secretary and treasurer; **George Frederickson, H. H. Ross, P. K. Sticelbar,** and **H. C. Webb,** vice presidents; and **R. R. Allen, Ruth Canaday,** and **John S. Kolstad,** assistant treasurers and assistant secretaries.

George W. Oliver, a veteran of 28 years with Humble Pipe Line Co., has been promoted to Southwest Texas division superintendent at Corpus Christi, Tex. Oliver has been acting in that position since June 1951. Other changes include: **Hickman E. Hensley,** district superintendent at Odessa, Tex., transferred to Midland, Tex., as assistant division superintendent for West Texas; **P. Harold Yolland,** assistant district superintendent at Pierce Junction, transferred to Odessa replacing Hensley; and **Marvin E. Banks,** acting as district superintendent at Odessa, officially appointed to that post.

Joe F. Wood, chief chemist for Skelly Oil Co.'s natural - gasoline division, has been named superintendent of the research laboratory at Pawhuska, Okla. Wood, who has been with Skelly for the past 15 years, received his degree in chemical engineering from Oklahoma A. & M. College.

R. Lee Thompson, tool pusher for George P. Livermore, Inc., at Rush Springs, Okla., has been transferred to Lubbock, Tex., and promoted to assistant drilling superintendent for Great Western Drilling Co. (the new name for the Livermore company).

John A. Sutherland, formerly junior mechanical engineer for Stanolind Oil & Gas Co. at Elk Basin, Wyo., has joined Sunray Oil Corp. at Benton, La., as senior engineer at the Benton cycling plant.

Dr. W. E. Wallace has joined Forrest Oil Corp. as chief geologist in charge of the firm's newly created Lafayette, La., office. He was formerly with Sohio Petroleum Co. **B. H. DeHart,** formerly with Tide Water Associated Oil Co., is also a geologist in the new office.

Curtis Dawes, vice president of Pure Oil Co., has been elected secretary of the firm, succeeding **Clarence H. Jay,** who has been both secretary and treasurer for the past year. Jay, who joined a predecessor company of the present Pure Oil Co. in 1903, will continue as treasurer. Dawes will assume his additional duties on January 1, and will make his headquarters in Chicago.

Joseph F. Taylor, assistant manager of the operations department for Shell Chemical Corp. at Deer Park, Tex., has been promoted to manager of the "A" operations department. **Oren L. Wylie, Jr.,** technical assistant in "C" department, has been promoted to assistant manager of "A" operations; and **Howard E. Hughes,** formerly chief engineer at the Dominguez, Calif., plant has been transferred to Deer Park as chief engineer.

PERSONALS

J. Durwood Pate has been appointed Oklahoma district geologist for Eason Oil Co., and **Eugene F. Culp** has been named junior geologist.

O. K. Taylor has been elected a director of Esso Shipping Co., affiliate of Standard Oil Co. (N. J.).

W. L. Tinslar, engineer trainee for Gulf Oil Corp. at Penwell, Tex., has been transferred to Goldsmith, Tex., and promoted to petroleum engineer.

Clarence O. Magee, petroleum engineer for Humble Oil & Refining Co., has been transferred from Raymondville to Refugio, Tex.

John W. Meador, economist for Great Lakes Corp., New York City, has been elected assistant vice president of the corporation.

T. M. Gregory, vice president of the First National Bank of Houston, has been elected a director of Kirby Petroleum Co., to fill the vacancy created by the death of David M. Picton, Jr.

Billy F. Latch, geologist for Continental Oil Co., has been transferred from Lamar, Colo., to Roundup, Mont.

Dal Nix, who joined Arabian American Oil Co. in 1940 as manager of the producing, pipe-lines, and transport departments, has been appointed general manager of oil operations for the company. **D. M. Brown,** who has been with Aramco since 1936, has been made manager of the producing, pipe-lines, and transport department. Other appointments include: **R. S. Hatch,** who joined Aramco in 1947 as manager of the manufacturing and processing department, named general manager for materials supply and traffic; **George Kraigher,** manager of the aviation department, appointed general manager of the department; and **Dr. Theodore E. Allen,** with Aramco since 1949 as assistant to the medical director, named associate medical director. The general-manager positions are newly created by Aramco.

John J. Garry will open offices January 1 at Levelland, Tex., as an independent operator in association with **Herman Graham,** contractor-producer of Salem, Ill. Garry was formerly a scout for **Walter Duncan.**

G. R. Monkhouse, general manager of the western division of Shell Chemical Corp., has been elected vice president of the western division, effective January 1. Offices will remain in San Francisco. He has been with the company since 1921, progressing through various marketing positions with Shell Oil Co. to division manager, becoming general manager of Shell Chemical's eastern division; and in 1948, general manager of the western division.

Dr. E. E. Barberii, associate professor of production in the petroleum-engineering department of University of Tulsa, has gone to Maracaibo to help the Venezuelan university establish a petroleum-research unit at the University of Zunia. He will return to T. U. early in 1952.

Ira J. Meador, production foreman for Skelly Oil Co. at Lindsay, Okla., has resigned and joined Cities Service Gas Co. at Garden City, Kans., as meter inspector.

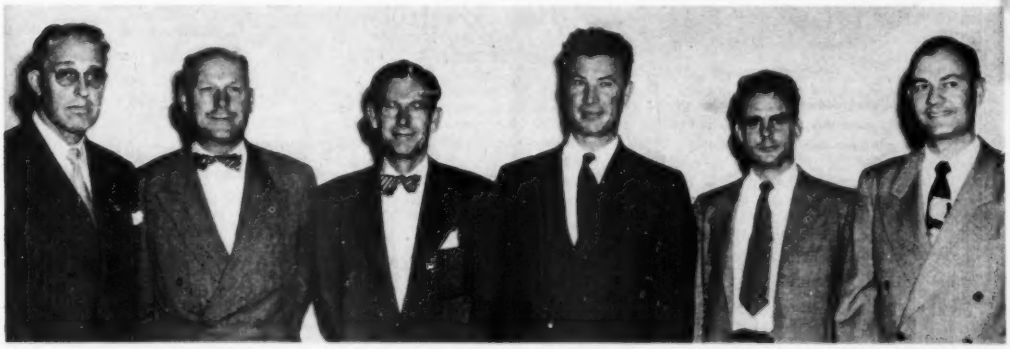
Ray C. Shibe has been appointed secretary-treasurer and a member of the board of directors of Wilshire Oil Co., replacing the late Willard D. Smith.

Arthur O. Detmar, formerly with Magnolia Petroleum Co. for 13 years, has joined McElroy Ranch Co. of Fort Worth as a geologist.

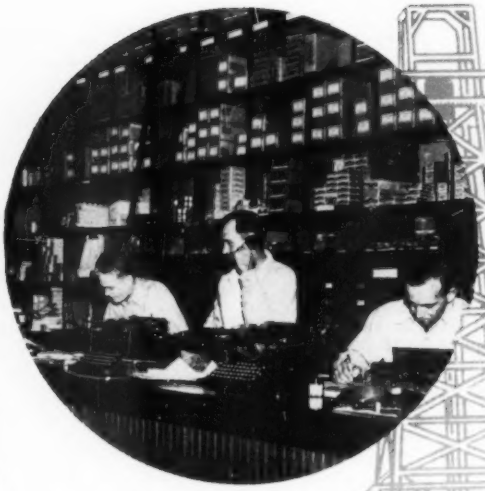
C. W. Turner has been elected president of American Bitumuls & Asphalt Co., a subsidiary of Standard Oil Co. of California. **C. W. Stewart,** formerly president of the company, has been named to the newly created position of vice chairman of the board of directors. Turner has been Standard's Honolulu district manager since 1940. Before going to Honolulu, he was assistant manager of the company's lubricant division.

James W. R. McLeod has been elected president and managing director of Merland Oil Co. of Canada, Ltd. Other officers elected include: **R. M. Linden,** vice president; **David Neil McLeod,** secretary-treasurer; **William Anderson, William Jeffrey, Alfred Hinds,** and **R. J. Adams,** directors.

L. W. Holsapple, of Sinclair Oil & Gas Co., Augusta, Kans., has been elected chairman of the Kansas section of the American Institute of Mining and Metallurgical Engineers, succeeding **G. L. Yates,** of the firm of Amstutz & Yates. Other officers named include **G. J. Decker,** of



A.P.I. OFFICERS.—New and retiring officers of the Los Angeles basin chapter of the American Petroleum Institute shown above are, left to right: Charles Gandaubert, General Petroleum Corp., retiring chairman for 1951; William Anderson, Oil Tool Corp., retiring secretary-treasurer for 1951; Stafford Park, Fullerton Oil Co., chairman-elect for 1952; Tal Ledbetter, Union Oil Co., vice chairman-elect for 1952; Art Curran, Schlumberger Well Surveying Corp., secretary-treasurer-elect for 1952; and Herman Schaller, McCullough Tool Co., assistant secretary-treasurer-elect for 1952. This picture was taken following the elections during the last meeting for 1951.



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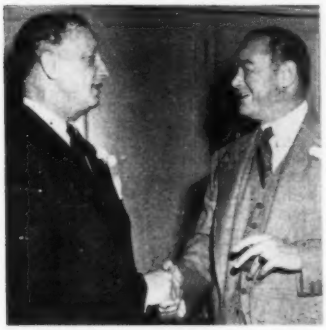
PERSONALS

Schlumberger Well Surveying Corp., vice president; **E. S. Arnold**, of Phillips Petroleum Co., vice chairman for eastern Kansas; **J. W. Meyers**, of Champlin Refining Co., vice chairman for western Kansas; and **H. L. Temple**, of Continental Oil Co., secretary-treasurer.

Kenneth R. Menk, recent Texas A. & M. College graduate, has joined Tide Water Associated Oil Co. at Midland, Tex., as assistant geologist. **James H. Cobbs**, 1951 University of Oklahoma graduate, has joined the firm as engineer trainee at Midland. **Audrey M. Cook**, field engineer at Venice, Tex., has been transferred to Kilgore, Tex., and **John W. Stephenson**, engineer trainee at Hobbs, N. M., has been moved to Odessa, Tex.

Robert L. Minckler, president of General Petroleum Corp., has been elected to his second term as president of the Western Oil and Gas Association. **L. L. Aubert**, president of Bankline Oil Co., was elected first vice president; and **Charles S. Jones**, president of Richfield Oil Corp., was elected second vice president. **L. K. Whittier**, vice president of Belridge Oil Co., was reelected treasurer, and **John M. Peirce** was reelected vice president and general manager. **Lowell Stanley**, chairman of the board of directors of Jergins Oil Co., was elected to the board, replacing the late C. M. Cotton.



NEW CHAIRMAN.—H. S. M. Burns, left, president of Shell Oil Co., New York, has been appointed chairman of the public-relations committee of the board of directors of the American Petroleum Institute. Burns is being congratulated by John M. Lovejoy, president of Seaboard Oil Co., New York, who retired as chairman of the committee recently after serving in that capacity since the beginning of the Oil Industry Information Committee in 1947. The O.I.I.C. is under the jurisdiction of the public-relations committee.

E. M. Paulk, resident engineer for Texas-Illinois Natural Gas Pipe Line Co. at Popular Bluff, Mo., has been transferred to Marshall, Tex., as district superintendent.

Orville D. Judd has been elected vice president of Sinclair Refining Co. Prior to joining the Sinclair organization on December 1, Judd was chairman of the Petroleum Branch, Office of Price Stabilization, Washington, D. C.

Henry Cardwell, formerly South Texas supervisor for Seaboard Oil Co. of Delaware, and more recently coordinator of land and geology for the Mid-Continent division, has resigned to become chief geologist for Spartan Drilling Co. and other G. H. Vaughn interests. His headquarters will be in Dallas.

J. J. Rogers has been promoted to superintendent of drilling for Long Beach Oil Development Co. He replaces **F. J. Kightlinger** who retires at the end of the year.

J. H. Sidwell, formerly chief engineer for Hiawatha Oil & Gas Co., has joined Imperial Production Corp. with headquarters in San Antonio, Tex.

Eugene M. Henderson has resigned as chief engineer of Interstate Oil Pipe Line Co., to become coordination assistant in the office of the coordinator of transportation activities of Standard Oil Co. (N. J.) with headquarters in New York City. Henderson joined Oklahoma Pipe Line Co., predecessor of Interstate, in 1935 after graduating from University of Oklahoma.

Lloyd F. Thanhouser, vice president and general counsel of Continental Oil Co., Houston, and **Rayburn L. Foster**, vice president and general counsel of Phillips Petroleum Co., Bartlesville, Okla., have been appointed members of the American Petroleum Industries Committee for 1952. Thanhouser succeeds **James J. Cosgrove**, former general counsel of Continental who has been chairman of the board of Continental since 1946. Foster's appointment enlarges A.P.I.C. from 10 to 11 members.

F. E. Hatfield has been appointed executive assistant to Vice President **J. F. Adams**, and manager of supply and services in the Fort Worth office of Gulf Oil Corp. Other changes and appointments include: **G. H. Fisher**, appointed assistant to the vice president for exploitation and manager of exploitation; **C. D. Cordry**, promoted to division staff geologist; **J. D. Moody**, appointed division geological supervisor; **K. W. Paul** appointed administrative assistant, exploration; and **T. Q. Williams**, assistant to the fiscal advisor to the vice president.

James D. Boynton, petroleum engineer for Standard Oil Co. of Texas, has been transferred from Royalty to Gainesville, Tex.

George W. Eaton, Jr., junior petroleum engineer for Stanolind Oil & Gas Co. at Abilene, Tex., has been transferred to Fort Worth and promoted to petroleum engineer in the reservoir section.

H. L. Lawler, operating engineer for Stanolind Oil & Gas Co. at Levelland, Tex., has been transferred to Tulsa and promoted to mechanical engineer in the development department.

George R. Colton, formerly assistant gas analyst for Sinclair Oil & Gas Co. at Seminole, Okla., has joined Amerada Petroleum Corp.'s production department at Midland, Tex.

T. C. Coleman, district drilling superintendent for Helmerich & Payne, Inc., has been transferred from Natchez, Miss., to Casper, Wyo.

DEATHS

Hubert Winen, 72, independent producer, died in Scottsville, Ky., December 12.

F. R. Kittrell, 50, drilling contractor, died in Tulsa December 26.

Ernest D. Crandall, 61, retired construction foreman with Shell Oil Co., died in Long Beach, Calif., December 20.

Irving Thomas Cadwell, 65, retired drilling foreman with The Texas Co., died recently in Long Beach, Calif. He joined Texaco in 1925, and retired in 1950 as a supervisory drilling foreman.

James McGrath, comptroller of Imperial Oil Co., Ltd., died at Toronto, Ont., Canada, recently.

Thomas I. Carter, 79, a retired vice president and director of Cities Service, died in New York December 18.

Crayton H. Bates, 74, former purchasing agent of the old Prairie Oil & Gas Co., died December 19 at Independence, Kans.

Floyd J. Morgan, 35, area supervisor for Larkin Packer Co., Inc., died recently of a heart attack while aboard an airplane en route from Evansville, Ind., to St. Louis, Mo.

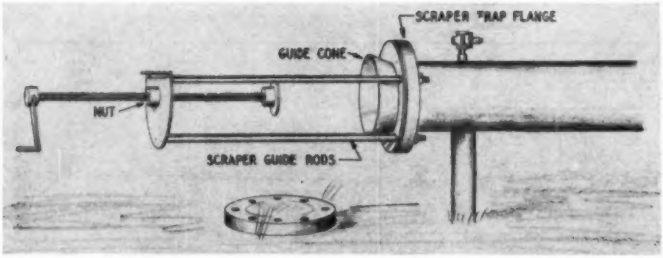


Fig. 1—Diagram of jack and guide device for attaching to scraper-trap flange.

Scraper-trap and piping details are discussed, including barrel dimensions, bypass lines, and valve installations. In a subsequent issue an article entitled "Pipe Line Scraper Practices for Natural-Gas Transmission Lines" will deal particularly with advantages of "on-stream" practices.

Pipe-Line Scraper Traps . . .

. . . for crude and products lines

by Paul Reed
Pipe-Line Editor

IMPROVEMENTS in scraper-trap design are making it possible to lower costs so as to get more runs per dollar in the routine operation of scrapers through petroleum pipe lines. This is becoming more important in this period when pipe-line systems are operating on high load factors to meet steadily increasing demands.

Designs of new scraper traps which incorporate the lessons learned by the industry can expedite scraper handling. Repetition of obsolete features should be avoided especially in new traps. In fact revamping of facilities is warranted on some systems which could profit from the advantages of modern types of traps and by the complete elimination of certain useless intermediate traps. Such traps are nuisances now that long-distance scrapers are widely used.

For modern scraping operations, valves and piping may frequently be modified to improve efficiency.

In discussing scraper-trap design, this article will deal with (1) diameter and length of barrels, (2) features of launching and receiving barrels, (3) advantages of quick-opening flanges, (4) details of bypass lines, and (5) installation of vent valves and line valves.

Many pipe lines still use traps which are far from efficient. Still more surprising is the fact that new lines are being built with the same obsolete designs.

Obviously no single type of scraper trap is suitable for all conditions on every line. There are certain basic features of scraper-trap design which have demonstrated their functional and safety value.

Advantages of oversize barrels.—This is the first feature in importance. Scraper-trap barrels which are fabricated from line pipe of the same size as the main system are not only inconvenient, but dangerous. The insertion of scrapers in these traps usually involves awkward procedures: Either a truck rams a skid to drive the scraper into the pipe, or chains, bars, and load binders are used to insert the scraper inch by inch. For rubber-cup plugs with no cleaning devices this is a trying task. For modern, wear-compensating scrapers with spring-loaded brushes or blades, such insertion requires a maximum of patience, ingenuity, and hard work.

Jacks and guides.—Some pipe liners have made this job simpler and safer by providing jacks and guides which clamp onto the scraper-trap flange and guide the tool into the pipe. An example of one of these "pig pushers" is shown in Fig. 1.

Use of an oversize barrel on both outgoing and incoming scraper traps is definitely important enough to warrant modification of existing traps. Two large crude-oil pipe-line systems are now engaged in just such a changeover program. The payoff in safety, both to the personnel and to the equipment, cannot be measured, but the saving in labor often amounts to the difference between a gang with a truck and two men with a wheelbarrow.

Naturally, the oversize barrel on the outgoing or insertion trap is more readily justified than on the receiving trap. The horizontal barrel with the main-line valve located aboveground is more advantageous for the removal trap than for the launching trap. The horizontal, oversize incoming barrel not only facilitates removal of the scraper, but also simplifies cleanout and flushing. Fluid circulation around the cups and brushes or blades helps prevent formation of an excessively solid mass of paraffin scale and dirt.

Barrel diameters.—The insertion or launching barrel as well as the receiving barrel may be made from standard line pipe one size larger than the main line. A more positive seal for the insertion barrel can be obtained by the use of heavy wall pipe of the larger size or specially rolled tubing of comparable inside diameter. If the receiving barrel is to contain a perforated strainer tube, as shown in Fig. 2, the tube may be either line-pipe size or larger, depending on the type of operation planned.

Strainer removal.—When the strainer is to be removed with the scraper intact, it may be desirable to have the cleaning tool fit fairly tight to prevent movement before removal. If the scraper is to be first removed from the barrel and strainer and the perforated element then pulled out, an oversize tube is desirable. This second condition seems preferable (though slightly more expensive initially) because the scraper and strain-

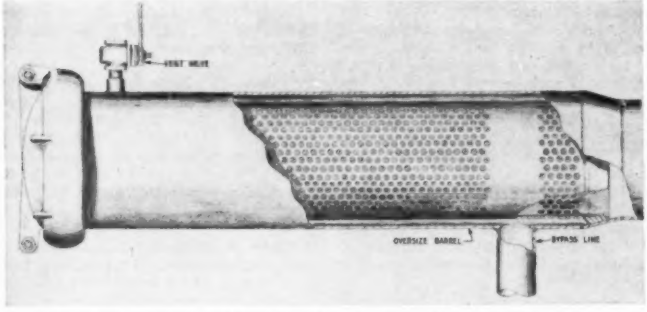


Fig. 2—Arrangement of launching barrel with perforated strainer tube.

er may be more easily handled and cleaned individually.

There is also some small advantage in having an increased strainer area. And reduced velocities improve sediment removal and settlement. While mentioning cleaning, it is well to remember that burning the strainer element may be a good way to remove the muck.

But don't ignite the scraper. Blades, brush mountings, and brush bristles are usually tempered high-carbon spring steel to provide flexibility, cleaning pressure, and long life. Heat from burning wax or oil-soaked dirt is sufficient to remove temper and ruin these parts. Spraying a heated scraper with cold water will cause embrittlement with subsequent breakage and loss in the line.

Barrel lengths.—This is next in importance to barrel diameter. Most existing scraper traps are much too long. The launching barrel should be about 1½ times as long as the longest scraper to be used. If it is any longer, it is not only a waste of space and material, but it is inefficient because it makes it difficult to push the scraper into the swage or reducer.

Launching-barrel design.—To insure positive movement out of the trap it is best that the tool be inserted as far as possible. To further aid in this operation, the swaged fitting or reducer at the outgoing end of the barrel should be as gently tapered as is practicable. In some sizes of barrel the end flange at the valve can be made by using an internally tapered, long welding-neck flange. This eliminates the reducer and provides a smooth inlet. In the larger sizes a long, rolled taper is desirable; in all sizes short reducers or overbored flanges are undesirable.

Receiving-barrel features.—The receiving trap should have an oversize barrel length between two and two and one-half scraper lengths. This allows space for an above average amount of dirt and trash and also insures room for a damaged scraper which may have to be propelled in by another scraper. In cleaner systems, labor can be saved by allowing two scrapers to arrive for removal at one time. If the trap is longer than recommended, it is usually hard to fish through the muck to hook the scraper. It is also difficult to clean and flush out the trap. The reducer or swage on the receiving barrel may be as short or as angular as is practicable since the shape will make little or no difference in the expulsion of the scraper from the line.

If a strainer is installed, some support should be provided at the reducer or valve end and no wide gap or shoulder should impede smooth scraper entrance.

Quick-opening flanges.—In both sending and receiving traps, the flanged end should be equipped with a hinged, quick-opening flange. The time saved in comparison with standard multiple bolt-type flange will soon pay for the installation.

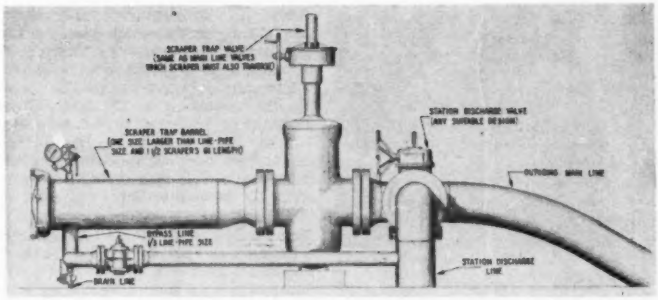


Fig. 3—Hookup of scraper trap on outgoing lines.

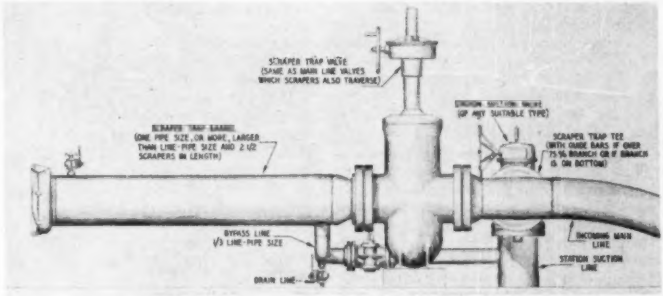


Fig. 4—Scraper trap installed on incoming main line.

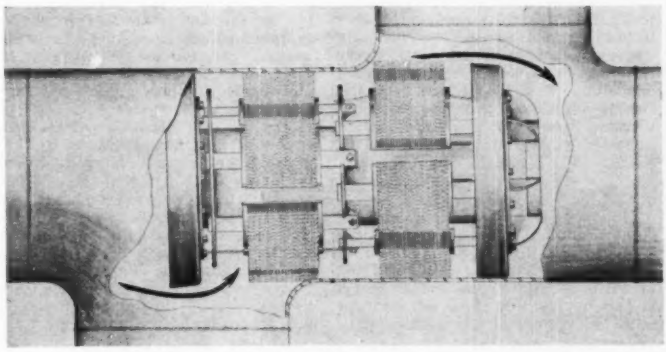


Fig. 5—Bypassing at side openings causes scraper stoppage.

Device for old traps.—For old traps with standard blind flanges, some time can be saved by carefully inserting a standard scraper cup into the pipe with its face against the blind. This will seal against leakage with the bolts installed hand-tight, eliminating the need for wrenching. This is not recommended for traps which are continuously exposed to line pressures, but rather for operations where the barrel is only pressured during scraper operations. In installations where incoming traps have the bypass outlet too close to the flange end, the cup also serves as a bumper between the scraper nose and flange.

Bypass lines of launching barrels.—Location and size of the bypass line seriously affects the efficiency of the trap. The bypass line of the launching barrel should enter at a point near the flange end. The bypass opening should be entirely behind the rear cup of the longest scraper to be installed. The diameter of the bypass line should be between one-half and one-fourth of the line-pipe size, depending on flow conditions and barrel and pipe-line sizes. Usually one-third of the line-pipe diameter is ade-

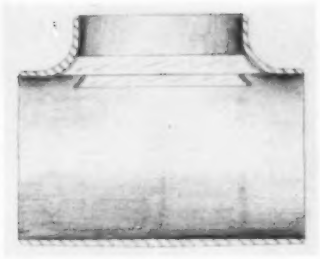


Fig. 6—Guide bars across side outlet openings.

quate for traps with barrels made from pipe one size larger than the main line. The capacity of the space between the cup lip and the trap wall should be exceeded by the capacity of the bypass line. The new scraper diameters of cup lips average 2⅛ per cent more than inside diameters of standard weight pipe.

Bypass lines of receiving barrels.—This should leave the barrel at a point as close to the entrance or valve end as possible. This will allow immediate dispersal of pressure and keep the scraper from being driven into the flange end. Disregard of this feature causes damage to scrapers from their striking the flange and damage to cups from flow trying to bypass cups as well as from overthrottling and from surges in the system. If a perforated liner or strainer is used, the location of this outlet or bypass is not so critical. To assure adequate circulation and maximum deposition of solids, it would be desirable not to perforate the liner immediately adjacent to the outlet or bypass line. If the bypass line can be fabricated to leave the top of the barrel, less solid matter will be carried out of the trap by the stream.

Drainage of scraper traps.—In the cases of both the launching and receiving traps, the bypass line or drain line should leave the bottom of the barrel to facilitate complete drainage. If the bypass line does not connect with the bottom of the barrel, facilities should be provided for draining directly from the trap. Because of the nature of the muck brought into the receiving trap, its drain line should be of at least 2-in. diameter. Of course, a larger line would speed up the operation of the trap. Trash brought in by the scraper can be kept out of the bypass valve and fittings beyond by welding pieces of expanded metal or similar sturdy screening over the bypass outlet.

Vent valve.—A vent valve should be installed on the top of each barrel. This vent should be of about the same diameter as the drain line. On the launching trap such a vent may have a pressure-gage connection. This pressure gage is useful for indicating condition and position of the scraper.

Valve installations.—Figs. 3 and 4 show the general design of scraper traps described here. In each case flanged main line valves are shown, but there would be no objection to making the scraper trap a permanent part of the piping with weld-end valves. In fact, a weld-end through-port valve with one end "venturied" to the larger size of the barrel would be ideal. In all cases the valve should have an opening that is equivalent to or larger than those used in the main line to facilitate scraper movements.

The seat rings should be full diameter, preferably with any lugs ground off, or at least 95 per cent of full diameter. The gap between the seat rings should not be excessive, as the closer seat-ring spacing makes possible the safe use of a wider variety of scrapers. With close seat-ring spacings or through-port valves, shorter, more flexible scrapers can be used, which means that sharper bends and more severe restrictions can be tolerated in the lines traversed. Of course, if special scrapers are used to traverse venturi gates or plug valves throughout the system, there is no reason why such valves should not also be used at the trap.

Station discharge and suction valves, scraper-trap bypass valves and miscellaneous drain and vent valves may be of any acceptable type. Plug valves on the bypass lines will give less trouble from dirt and afford quick operation. The larger valves such as the scraper-trap valve and station suction and discharge valves may be motorized and provided with an interlock which prevents accidental pinching of the station line valves before the scraper trap and bypass valves are completely opened.

Bends at trap.—At the trap these should be no sharper than those found along the line. A good rule to follow on these bends is to provide a radius of curvature of 3½ ft. or more on sizes up to 5-in., 7 ft. or more up to 12-in., and seven pipe diameters or more on larger sizes. This again assumes that standard liquid line scrapers will be used which are suitable for traversing the valves. If scrapers are provided for passing through welding ells, the same ells may, of course, be used adjacent to the trap. Welding ells of angular length up to 22½° may be safely used with some types and sizes of oil and products line scrapers, but scraper designs should be checked in regard to this aspect before they are used.

Scraper-trap fittings.—Other fittings must also be designed and assembled so that free scraper passage may be assured. Some scrapers will not pass heavy-wall forged tees which have the wall thickness tapered on the inside with a reduced central diameter. Others will not pass large-diameter side openings which intersect the pipe at an angle. All side openings should be planned with scraper cup spacings considered. If a station bypass line or other auxiliary line enters or leaves the main line near the trap, avoid welding the tees adjacently. Such fabrication may result in scraper stoppage because of the large volume of bypass around the cups as shown in Fig. 5. Any branch or side opening equal to 75 per cent or more of the pipe diameter should open to the side or top of the pipe line. If there is to be a partial flow leaving the line at this point during scraper passage, the tee or opening should be equipped with guide bars. A suggested design shown in Fig. 6 will prevent the scraper from turning without appreciably affecting the flow.

Types of scrapers.—It is evident that the best design of a scraper trap

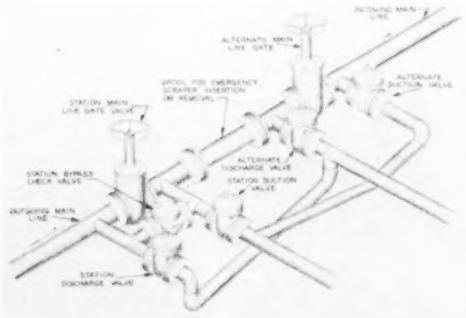


Fig. 7—Arrangement for bypassing of station.

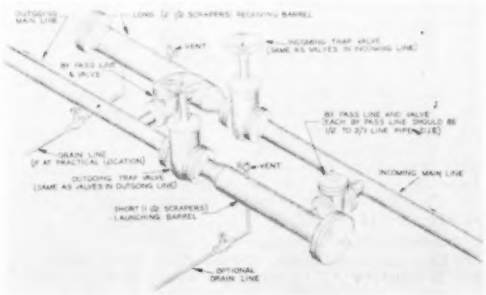

OUTGOING MAIN LINE
LONG (2 OR 3) SCRAPERS RECEIVING BARREL
VENT
INCOMING TRAP VALVE (SAME AS VALVES IN INCOMING LINE)
BY PASS LINE & VALVE
BY PASS LINE AND VALVE EACH BY PASS LINE SHOULD BE (2/3 TO 3/4 LINE PIPE SIZE)
DRAIN LINE (IF AT PRACTICAL LOCATION)
VENT
OUTGOING TRAP VALVE (SAME AS VALVES IN OUTGOING LINE)
INCOMING MAIN LINE
SHORT (1 OR 2) SCRAPERS LAUNCHING BARREL
OPTIONAL DRAIN LINE

Fig. 8—Hookup of intermediate trap installation.

can only be achieved when the conditions of operation, the type of scraper, and the characteristics of the pipe line are clearly determined. In many cases, one or more of these factors remains unknown until after scraper-trap installation, or until after changes have been made during construction or early operation. Improvements in scraper design need to be reckoned with sometimes as well as additional scraper functions or attachments and changes in existing lines which might also alter trap requirements. It is therefore advisable to make the traps as universally usable as possible. As an aid in this respect, refer to the accompanying table. Compiled from information furnished by manufacturers and from field measurements, the table shows maximum over-all dimensions of the longest commonly used scrapers. Scrapers made in pipe-line shops and multiple units which are made up of complete scrapers joined together may exceed the lengths shown. On the other hand, since maximum dimensions are given, it should be remembered that most scrapers are considerably shorter, particularly in the smaller-diameter sizes.

Traps for special situations.—To this point the discussion has been concerned with only the conventional scraper trap designed for efficient insertion and removal of scrapers during continuous operation. Usually such traps are located in the pump-station yard and often become an integral part of the station piping. Many variations of the conventional design have been built to satisfy extraordinary conditions.

Traps have been built with vertical barrels extending up to a platform to permit scraper operation during floods which submerged the right-of-way.

A piping arrangement for moving a batching plug past products line booster stations might not be called a "trap." By proper manipulation of the valves shown in Fig. 7 the plug can pass the station without shutdown and with a minimum of contamination.

An intermediate trap as shown in Fig. 8 is used where line sizes or operating conditions call for a scraper change. Additional parallel barrels are added where the number of lines changes.

Another type of intermediate trap has no barrel as such, but is merely a large tee with a hinged top flange, bypass line, and secondary bypass. This trap, shown in Fig. 9, requires no drainage facilities. It can be operated so that one scraper either passes straight through, stops to be removed at a convenient time or, when stopping, launches a previously installed new scraper.

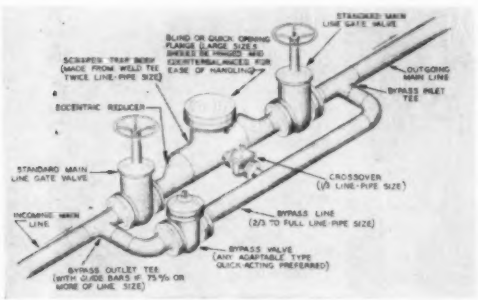

STANDARD MAIN LINE GATE VALVE
BLIND OR QUICK OPENING FLANGE (LARGE SIZES SHOULD BE HINGED AND COUNTERBALANCED FOR EASE OF HANDLING)
SCRAPER TRAP BODY (MADE FROM WELD TEE TWICE LINE-PIPE SIZE)
OUTGOING MAIN LINE
BYPASS INLET TEE
ECCENTRIC REDUCER
STANDARD MAIN LINE GATE VALVE
CROSSOVER (1/3 LINE-PIPE SIZE)
INCOMING MAIN LINE
BYPASS LINE (2/3 TO FULL LINE-PIPE SIZE)
BYPASS VALVE (ANY ADAPTABLE TYPE QUICK-ACTING PREFERRED)
BYPASS OUTLET TEE (WITH GUIDE BARS 4" TO 75% OR MORE OF LINE SIZE)

Fig. 9—Intermediate trap having no barrel.

Elimination of unnecessary traps.—The advent of scrapers which can clean effectively for hundreds of miles has made many intermediate traps a nuisance instead of a necessity. Most of the traps which were installed in long lines for renewal of brushes, blades, or cups should now be removed or spooled for through passage. In some cases this can be done with traps at the station and when considering new construction, alignment of the traps for subsequent spooling should certainly be considered.

In many instances, simpler traps such as shown in Fig. 10 can be used. These are applicable at loading docks, tank farms, terminals, refineries, and other locations where line operation is intermittent or where it is not objectionable to shut down for scraper insertion.

It has not been the purpose of this article to show why scrapers should be run, how often they should be used or under what circumstances they are beneficial. The purpose has been to point out that if scrapers can bring a pipe line up to a certain economical level of efficiency, then the use of efficient scraper traps will lower scraping costs and make it possible to get more runs per dollar or justify an even higher level of efficiency.

Maximum Scraper Lengths

The following lengths are maximum over-all dimensions of standard pipe-line scrapers in common use.

Size (in.)	Length (in.)	Size (in.)	Length (in.)
2	17	14	48
2½	17	16	44
3	16	18	49
4	24	20	53
5	26	22	55
6	30	24	57
8	35	26	59
10	40	30	65

The use of these dimensions as a basis for scraper-trap design will allow sufficient space for the maximum-length scraper. Shorter, more compact traps can often be used and it is recommended that over-all dimensions for the actual scrapers to be run be used instead of these maximums.

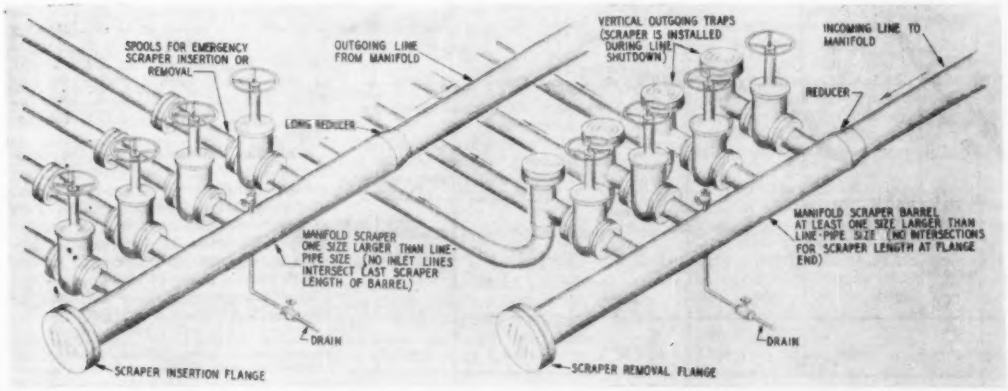
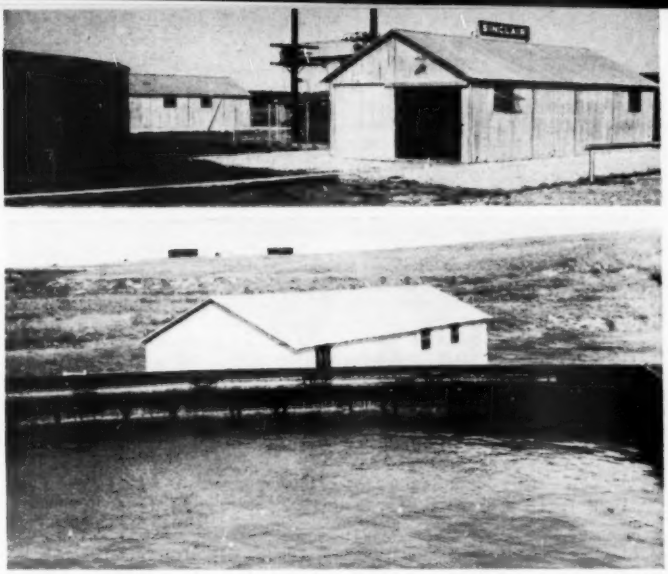

SPOOLS FOR EMERGENCY SCRAPER INSERTION OR REMOVAL
OUTGOING LINE FROM MANIFOLD
VERTICAL OUTGOING TRAPS (SCRAPER IS INSTALLED DURING LINE SHUTDOWN)
INCOMING LINE TO MANIFOLD
REDUCER
LONG REDUCER
MANIFOLD SCRAPER ONE SIZE LARGER THAN LINE-PIPE SIZE (NO INLET LINES INTERSECT LAST SCRAPER LENGTH OF BARREL)
MANIFOLD SCRAPER BARREL AT LEAST ONE SIZE LARGER THAN LINE-PIPE SIZE (NO INTERSECTIONS FOR SCRAPER LENGTH AT FLANGE END)
DRAIN
DRAIN
SCRAPER INSERTION FLANGE
SCRAPER REMOVAL FLANGE

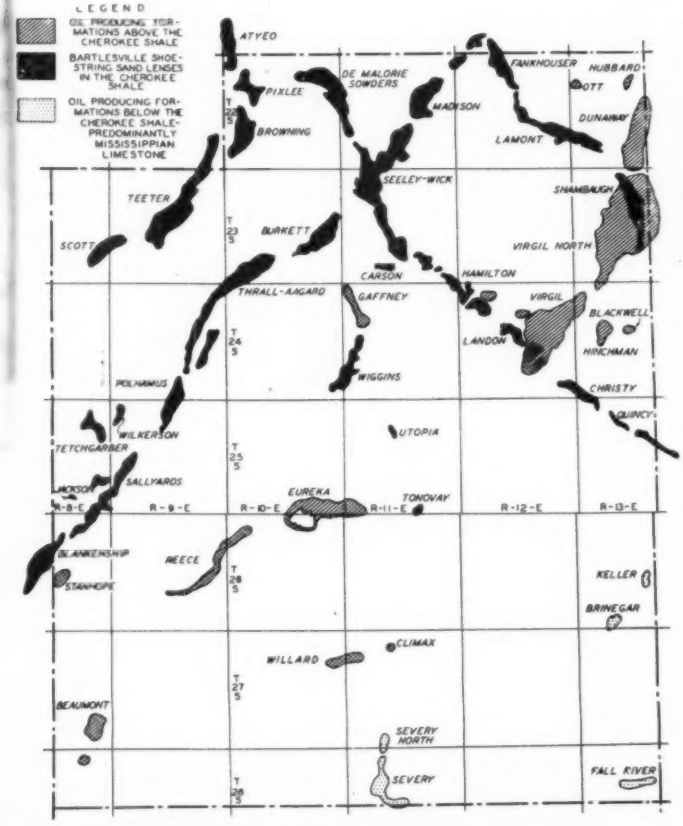
Fig. 10—Simple type trap used in manifolds for loading racks, tank farms, and similar installations.

WATER FLOODS in Greenwood County, Kansas*

. . . The 16-year history of the recovery of more than 20 million barrels of oil by this means in an old producing area.



Douglas sand water, fresh water, and produced water are treated in this slow-sand filter of Sinclair Oil & Gas Co. Top view is from ground level, and lower view is from top of partitioned tank.



Map of Greenwood County, Kansas, showing location of oil fields.

Introduction

OIL has been produced in Greenwood County, Kansas, for almost 50 years, the discovery well being drilled in 1905 near Toronto. Discovery of Mississippian limestone production was made in Virgil field in 1916, and the first production from a Bartlesville "shoestring sand" was obtained in 1917, in Sallyards field. Additional Bartlesville production was obtained in Teeter field in 1921, and in Browning, Burkett, and Seeley fields in 1922. In 1923, Aagard field was discovered and the development of the "Golden Lanes" of the Bartlesville sand stringers progressed at a rapid rate in the middle 1920's.

Shoestring trends.—The Bartlesville "shoestring sands" were found to occur in four trends of sandstone lenses that were deposited in the Cherokee shale of Pennsylvanian age. These trends were established as off-shore bars on two separate shore lines by N. Wood Bass of the State Geological Survey of Kansas. The Teeter and Quincy trends were deposited on one shore line and the Sallyards and Lamont trends were deposited on another.

Bass also determined that the sandstone lenses of the Teeter-Quincy trends were deposited prior to those of the Sallyards-Lamont trends. Two of the trends intersect at the Seeley-Wick field where a difference of approximately 50 ft. was found in the depth of the bases of the lenses.

Gas repressuring was initiated in the Bartlesville sand in 1935, and re-

*Papers prepared for tour of several Greenwood County, Kansas, water floods, October 11, 1951. Sponsored by Kansas section of the American Institute of Mining and Metallurgical Engineers and the Kansas-Oklahoma water-flood operations.

pressuring operations have been conducted in Browning, Burkett, DeMalorie-Sowders, Madison, Scott, Teeter, and Thrall-Aagard fields. However, most of these projects, although generally successful, have been discontinued in favor of water flooding.

The Tonganoxie sand in the Douglas group, commonly known as the "Big Water" sand or simply the "Douglas" sand, occurs throughout most of Greenwood County at depths from 800 to 1,200 ft. As the production from the solution-gas Bartlesville reservoirs began to decline, poorer wells were plugged and abandoned.

First legal flood.—The plugging practices observed at the time seldom provided effective isolation of the Bartlesville sand from the upper water sand, and operators were quick to observe increases in production from wells in the vicinity of plugged wells.

However, water flooding was not authorized by the Kansas Corporation Commission until 1935, and the York State DeMalorie "C" lease became the first legal water-flood project in the state in the same year. This flood is still in progress and is now operated by Phillips Petroleum Co.

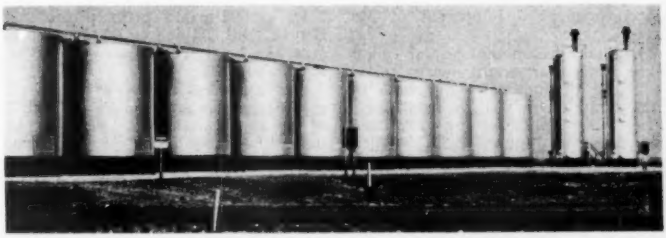
Water supplies.—Many of the water-flood projects in Greenwood County have used the Douglas water for flooding. However, variations in the thickness of the water sand in some areas, and the depletion of the water supply itself in other areas, has led to the use of water from the Arbuckle zone and surface water in many of the newer projects. Both "open" and "closed" water systems are used with the Douglas water, while open systems are generally used with either Arbuckle or surface water.

At present, water-flood projects in, and immediately adjacent to, Greenwood County have an annual production of about 5 million barrels from a total developed area of almost 10,000 acres. The potential floodable area of the projects now in progress is over 15,000 acres, and it has been estimated* that there are 20,000 floodable acres in the Greenwood County area. If an average development cost in the range of $1,500 to $2,000 per acre is assumed, the present water-flood development would represent an investment of between 15 and 20 million dollars.

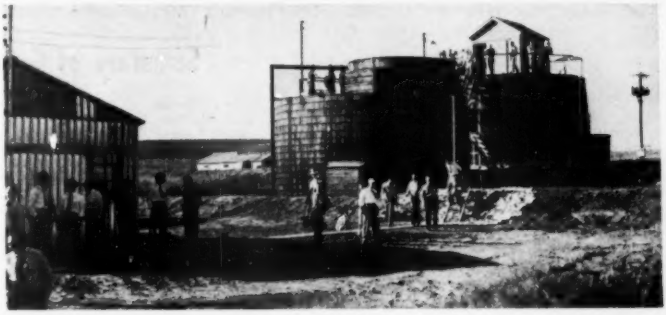
Recoveries.—It is estimated that more than 178 million barrels of oil have been produced up to July 1, 1951, of which more than 20 million barrels have been recovered by water flooding. The recovery of these 20 million barrels has required the injection of 163 million barrels of water. The average water-flood recovery to date slightly exceeds 2,000 bbl. per developed acre.

It will be noted from the table that several projects have already recovered more than 6,000 bbl. per acre. If an average water-flood recovery of 5,000 bbl. per acre is assumed from an ultimate area of 20,000 acres, a total water-flood recovery of 100 million barrels is indicated.

*Interstate Oil Compact Commission "Summary of Secondary Recovery Production Statistics and Estimated Water Flood Reserves—Kansas 1948," compiled by Albert E. Sweeney, Jr.



Tank battery and large separators on Ohio Oil Co.'s Martindell-Teeter water-flood plant.



Filter-plant system at Cities Service Oil Co.'s Teeter unit water flood for treating both fresh and produced water.

Sohio Petroleum Co.'s Bill Lane explains the closed water system on his company's Polhamus unit to some 300 water-flood operators on tour of Greenwood County floods.

Martindell-Teeter Water-Flood Unit of Ohio Oil Co.

Ohio Oil Co. Martindell-Teeter water-flood unit consists of the 640-acre Martindell lease located in 31-23s-10e, and the 160-acre Teeter lease located in the NE ¼ of 6-24s-10e. It is in the northeastern portion of Thrall-Aagard pool, about 1 mile southwest of Thrall, Kansas.

Production is from the Bartlesville sand found at an average depth of 2,296 ft., 894 ft. subsea. The total producing area is about 435 acres with an average net sand thickness of 55 ft. However, only 250 acres, with an average net sand thickness of 61 ft., are thought to be affected by the flood.

Core ananlyses have been made on 22 wells of the unit. From these, the average permeability of the sand was calculated to be 13.59 md., the average porosity to be 16.53 per cent and the residual oil to be 21.22 per cent. The oil and water saturation has been calculated to be 47.48 and 36.7 per cent, respectively.

Primary production. — Original development began on the Martindell lease in 1923, with 34 wells being completed by 1927. This gave an esti-

mated original development of 310 acres.

Original development on the Teeter lease, then Cartwright lease, began with the drilling of a dry hole in 1922. One other well, a small producer, was completed June 1924 and abandoned in January 1935. No primary production figures are available for this lease. The first water-flood development on the Teeter lease began February 1950, with the wash down of old hole No. 2. So far, only two wells, both producers, have been completed on this lease since water flood began May 1948. By October 1941, an estimated primary production of 1,901,850 bbl. or 6,135 bbl. per acre had been accumulated from the Martindell lease.

Gas injection.—On October 1, 1941, gas injection was commenced into 7 of the 28 oil wells remaining at this time. The gas-injection program was not very successful as only about 170,000 bbl. or 548 bbl. per acre had been recovered due to gas injection by May 1948, when water flooding began.

Thus an estimated total of 2,071,850 bbl. or 6,683 bbl. per acre was produced from the Martindell prior to water flooding. Because complete records of early production are not available, the annual production from 1923 to 1927 has been estimated.

Water flooding.—Initial water flood on the Martindell lease began in May 1948 with water being injected into a pilot flood consisting of four input wells, W-1, W-2, W-3, and W-4. The initial injection rate was 872 bbl. per day and the oil production was 114 bbl. per day.

First increase in oil production was shown in March 1949, when the daily oil production increased to 133 bbl. per day. Since then, the unit has been developed on a five-spot pattern with

Summary of Greenwood County Water-Flood

Name of flood—	Operator	Developed acres	Potential acres	Average T.D.	Acre spacing	Core data: Avg. net ft. SD.	Core data: Avg. perm. M.D.	Core data: Avg. por. (%)	Date of first inj.	No. of wells: Oil	No. of wells: Input	No. of wells: Supply
Atyeo pool												
1. Atyeo	Ohio	275	290	2,188	8.8	35	54.5	19.2	7-47	39	23	1
2. Jones	Barbara	60	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Batesville pool												
3. Batesville	Bird-Sheedy	(No information available on this flood)										
Blankenship pool												
4. Unknown	Branine-Goering	(No information available on this flood)										
5. Dickenson "B"	Tide Water	160		2,400		35	37	18		18	12	1
6. Hughes	Franco-Central	15	80	2,450	6	50			8-51	9	2	1
7. Sallyards	Sohio	70	155	2,500	10	50	25	18	5-49	11	9	1
Browning pool												
8. Browning Unit	Sinclair	70	1,000	2,300	10	51	48	18	11-49	73	7	4
Burkett pool												
9. Burkett Unit	Phillips	665	685	2,118	10	38	7	16	9-41	88	71	5
Carson pool												
10. Carson Unit	McGinnis		200	1,985	10	(To start injection in last quarter of 1951)						
DeMalorie Sowders field												
11. DeMalorie Sowders	Phillips	85	820	2,120	20	45	7.1	15.2	4-49	53	5	5
12. Pix Unit	Phillips	25	40	2,194	20	54	NC	NC	4-49	2	2	
13. J. D. Clopton	Mid-Continent	160	160	2,100	10	27	NC	NC	10-46	9	3	1
Fankhauser pool												
14. Childers	Harrigan	5	10	NR	20	NR	NC	NC	NR	1	1	
15. Fankhauser Unit	Sunray	800	800	1,900	10	37		15.6	7-49	27	22	4
16. Lauck & McIlvain	Phillips	100	100	1,920	20	40	79.6	20.9	1-43	7	6	1
Hamilton pool												
17. Patterson	Cities Service	200	200	1,850	10	45	30	17.7	9-46	29	20	6
Lamont pool												
18. Lamont Unit	Cities Service	690	690	1,700	10	37	57	20	5-49	62	26	
Madison pool												
19. Kipfer McGilvray	Magnolia	65	65	1,900	20	25	NC	NC	9-49	5	6	1
20. Madison	Cities Service	1,130	1,130	1,875	20	29	30	17.5	10-48	38	21	3
Pixlee pool												
21. Browning-Pixlee	Barbara	100	168	2,300	10	22	30	19	6-47	19	10	2
Polhamus pool												
22. Glennwood	Glennwood	260	260	2,300	12	34	15	20	4-49	32	20	2
23. Polhamus	Sohio	190	190	2,250	8.3-13.3	31	31	18	5-49	26	30	3
Quincy pool												
24. Quincy	Layton	50	400	1,500	7.6	35	40	20	1-50	10	10	1
Sallyards pool												
25. Ladd	Ohio	205	350	2,402	8.3	51	29.8	18.9	3-46	38	30	4
Scott pool												
26. Scott Unit	Phillips	200	750	2,605	20	35	85	20	10-45	41	12	2
Seeley-Wick field												
27. Beal Unit	Phillips	40	600	1,963	10	70	8.4	16.2	7-50	59	4	1
28. Clopton	Cities Service	250	250	1,950	10	36	21	17	3-46	25	21	3
29. Cragan	Cities Service	5	(No information available)									
30. McGilvray Unit	Phillips	95	430	1,994	20	37	6.7	16.9	6-50	35	5	2
31. Seeley Unit	Magnolia	550	550	1,975	10	32	27	18	1-43	63	60	11
32. Seeley-Wick Unit	Phillips	167.5	250	1,960	13	30	12	18	12-43	25	19	2
33. Wick	Skelly	600		1,900	10	37	NR	NR	1947	40	12	2
34. DeMalorie-O'Neal	Phillips	280.5	300	1,997	10	47	28.7	17.4	5-35	34	30	3
35. York Wescott	Phillips	62	96	1,984	6.4-12.8	29	NC	NC	11-43	12	9	1
Teeter pool												
36. Morris	Refiners Oil Co.	(No information available on this flood)										
37. Shambaugh Unit	Ohio	36.73	74	2,391	10.3	32	79.8	19.8	8-44	8	5	3
38. Teeter	Cities Service	1,160	1,160	2,550	20		NR	NR	11-47	19	12	3
Thrall-Aagard pool												
39. Aagard Unit	Phillips	47.5	60	2,150	6.4	40	16	17	7-37	5	3	1
40. Bratton	R. Orr	8	40	2,150	6.4	50	7	16	2-45	2	2	0
41. Cartwright	Phillips		165	2,350	15	35	14	18.8		15	14	1
42. Gard Block	Phillips	69	200	2,170	13	39	10	16	9-41	16	12	1
43. Lewis-Cannon	Phillips	80	120	2,310	12.8	48	10	16	5-45	10	9	1
44. E. Marshall lease	Arkansas Fuel	84	84	2,335	8.3	37	41.4	20.2	12-44	14	3	1
45. Martindell-Teeter	Ohio	250	300	2,296	10.3	61	13.6	16.5	5-48	41	29	1
46. Olson-Anderson	Ohio	98	98	2,170	9.1	53	17.1	17.8	4-44	13	9	1
47. Thrall-McKee	Sinclair	628	721	2,300	Irregular	31	39	18	6-49	61	57	8
Virgil field												
48. Johnson	Landon	(No information available on this flood)										
Wiggins pool												
49. Wiggins Unit	W. A. McGinnis		530	1,864	10	(To start injection in last quarter of 1951)						

like wells approximately 680 ft. apart, to a present 41 oil wells and 33 injection wells. However, only 29 input wells are being used at the present time. Thirty-nine of the oil wells and all of the injection wells are on the Martindell lease.

All the injection wells were drilled since water flood except three, W-30, W-31, and W-32. Input W-30 was converted from salt-water-disposal well No. 10 and W-31 was a conversion of producer 14. Input W-32 was a wash down of abandoned oil well No. 12. The two converted wells were cleaned out and new 2-in. tubing equipped with a Larkin packer run in them. The new input wells were completed with 4½ or 5½-in. o.d. casing equipped with a Larkin packer shoe set at the top of the sand and cemented with 100 sacks of cement.

Twenty-seven old wells, including the seven wells used for gas injection that were converted back to oil wells, are used for oil production. Fourteen new oil wells, including three old abandoned holes which were washed down, were drilled. The new oil wells were completed with 5½-in. o.d. casing equipped with a Larkin packer shoe set near the top of the sand and cemented with 100 sacks of cement. It was the general practice to shoot the oil wells but not the injection wells.

Water source.—Water for flooding was originally obtained from the produced water and a supply well drilled into the Douglas sand at a depth of 1,280-1,345 ft. However, as the water flood progressed, another supply well was completed to the Arbuckle lime at a depth of 2,890-3,248 ft. This well is eqiupped with a 97.5-hp. Reda motor set at 1,024 ft. on 4½-in. o.d. tubing. At the present time the Douglas water is not being used. The Ar-

Projects Data as of July 1, 1951

Name of flood—	Type Injection wells	Water source	Type treatment	Daily water input	Barrels water inj. to date	Water-flood recovery to date (bbl.)	Water-flood recovery B/A	Primary recovery B/A	Surface injection pressure	Present prod. BOPD	Present prod. BWPD
Atyeo pool											
1. Atyeo	D	Arbuckle	Lime & $CuSO_4$	4,861	4,008,191	887,810	3,228	8,300	268	600	3,100
2. Jones	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Batesville pool											
3. Batesville											
Blankenship pool											
4. Unknown											
5. Dickenson "B"	D & C	Arbuckle	Lime	1,500	1,163,399	228,415	1,428		0-100	350	520
6. Hughes	2D	Douglas	None	40				10,000	20	36	50
7. Sallyards	9D	Arbuckle	Lime	1,050	550,000	93,500	1,380	6,000	300	220	175
Browning pool											
8. Browning Unit	C	Douglas	None	2,246	1,287,916	None			None	254	123
Burkett pool											
9. Burkett Unit	70D, 4C	Douglas	Formaldehyde	10,357	25,370,960	4,202,081	6,317	4,600	860 max.	817	8,179
Carson pool											
10. Carson Unit											
DeMalorie Sowders field											
11. DeMalorie Sowders	5C	Douglas	Bionol "A"	1,502	838,469	16,622	196	8,000	828	345	95
12. Pix Unit	2C	Douglas	Bionol "A"	434	468,955	31,086	1,243	9,500	820	93	60
13. J. D. Clopton	3C	Douglas	Dearborn	550	301,916	40,296	252	2,095	475	70	210
Fankhauser pool											
14. Childers	1C	Douglas	None	148	383,579	NR	NR	NR	171	NR	NR
15. Fankhauser Unit		Douglas	None	5,630	3,617,671	975,539	1,219	132	520	750	3,950
16. Lauck & McIlvain	1D, 5C	Douglas	None	1,131	1,982,407	204,075	2,041	3,110	93	83	1,035
Hamilton pool											
17. Patterson	20D	Douglas & Creek	Alum	4,310	6,982,571	1,105,321	8,068	6,679	680	385	3,221
Lamont pool											
18. Lamont Unit	D & C	River	Alum and lime	4,690	4,104,017	367,447	1,577	6,298	400	519	4,475
Madison pool											
19. Kipfer McGilvray	C	Douglas	None	1,700	450,369	14,231	220	Unknown	250	55	41
20. Madison	D & C	Douglas & River	Alum and lime	2,691	2,933,487	68,465	263	5,462	275	312	756
Pixlee pool											
21. Browning-Pixlee	D	Douglas	Hexametaphosphate	2,700	4,176,885	136,563	1,365	4,900	370-830	72	1,350
Polhamus pool											
22. Glennwood	1D, 1C	Douglas	Hexametaphosphate	4,000	2,364,000	NR	NR	NR	420	900	1,400
23. Polhamus	30D	Douglas	None	3,300	2,033,485	350,489	1,740	7,000	220	750	1,500
Quincy pool											
24. Quincy	D & C	Arbuckle	Alum and lime	1,700	575,000	100,000	2,000	1,000 est.	550	350	700
Sallyards pool											
25. Ladd	30D	Douglas	Lime & $CuSO_4$	4,573	7,583,943	814,711	3,974	7,874	578	229	3,416
Scott pool											
26. Scott Unit	12C	Douglas	Formaldehyde	3,612	5,075,649	187,923	914	7,000	139	168	1,966
Seeley-Wick field											
27. Beal Unit	4D	Douglas		1,292	477,379	2,798	70	6,980		122	38
28. Clopton	21D	Douglas	None	3,714	6,347,201	608,765	3,250	4,722	550	159	2,557
29. Cragan											
30. McGilvray Unit	5C	Douglas	Formaldehyde	2,294	642,877	32,304	340	4,070	497	158	238
31. Seeley Unit	60D	Douglas	None	13,250	19,916,152	3,250,000	5,910	6,000	600	560	12,400
32. Seeley-Wick Unit	1D, 22C	Douglas	Formaldehyde	3,068	5,751,217	452,530	2,702	2,760	500	116	926
33. Wick		Douglas	Briquette	2,626	1,950,173	NR	NR		60-350	267	1,370
34. DeMalorie-O'Neal	30D	Douglas	Lime	4,728	15,505,446	1,743,762	6,217	5,780	160	489	4,290
35. York Wescott	5D, 4C	Douglas	Lime	403	2,272,785	168,500	2,106	2,960	Gravity	48	403
Teeter pool											
36. Morris											
37. Shambaugh Unit	5D	Douglas	None	1,221	4,801,855	132,932	1,821	7,131	168	18	497
38. Teeter		Douglas	Alum	1,830	2,607,573	109,548	577	6,261	650	494	432
Thrall-Aagard pool											
39. Aagard Unit	1D, 3C	Douglas	None	605	2,417,018	353,956	7,452	4,720	380	24	131
40. Bratton	2C	Douglas	None		707,080	66,450	8,306	4,410		3	22
41. Cartwright	13C, 1D	Arbuckle	(To start injection last quarter 1951)					6,000		97	NR
42. Gard Block	2D, 12C	Douglas	Formaldehyde	1,967	5,502,358	839,988	7,636	4,190	800	114	1,185
43. Lewis-Cannon	2D, 8C	Douglas	Formaldehyde	1,863	3,679,541	505,336	6,317	7,850	744	95	1,193
44. E. Marshall lease	3C	Douglas	None	700	1,521,824	277,776	3,307	6,370	250-510	115	435
45. Martindell-Teeter	29D	Arbuckle	Lime & $CuSO_4$	6,703	3,935,370	639,630	2,559	6,135 est.	416	1,645	2,408
46. Olson-Anderson	9D	Douglas	Lime & $CuSO_4$	1,963	4,564,149	592,447	6,045	4,092	781	85	1,153
47. Thrall-McKee	C & D	Douglas	None	17,691	4,659,951	459,787	730	Unknown	0-290	1,522	1,493
Virgil field											
48. Johnson											
Wiggins pool											
49. Wiggins Unit											

buckle well is producing 4,365 bbl. per day with the remaining necessary water coming from the produced water.

Water treatment.—From the supply well the water goes to an aerating tower where the iron in the Arbuckle water is oxidized and the hydrogen sulfide gas and free carbon dioxide liberated. The produced water goes from the heater-treaters to the aerating pit where it is mixed with the Arbuckle supply water. Then the mixed water flows by gravity through a chemical feeder to a settling pit.

Approximately 5 lb. of lime per 100 bbl. of water is put into the water by the chemical feeder. Copper sulphate is mixed with the water, when needed, to kill algae growth. The lime removes the iron carried in solution, reduces the carbonate supersaturation of the water to a point where the water will be stable, and increase the pH value of the water.

From the settling pit, the water flows by gravity through three sand and gravel filtering tanks and then into a 500-bbl. clear-water tank. From the clear-water tank the water is injected into the formation by an electrically driven Oil Well 4 by 6-in. triplex pump.

The clear-water tank is equipped with two floats. One regulates the amount of water coming into the tank and the other is an electric float which stops the triplex pump if the water level becomes too low in the clear-water tank and starts it when the water level rises to within approximately 1 ft. of the top of the tank.

As of August 1, 1951, a total of 3,935,370 bbl. or 9,047-bbl. per acre has been injected into the unit. The oil production since water flood is 639,636 bbl. or 2,559 bbl. per affected acre. The present daily production is 1,645 bbl. of oil and 2,338 bbl. of water. The present injection rate is 6,703 bbl. of water per day. The present monthly injection ratio, barrels of water injected per barrel of oil produced, is 4.1 and the monthly water-oil ratio is 1.4.

It is estimated that 604,000 bbl. of oil, or 2,426 bbl. per acre, has been produced by water flooding above that which would have been produced by a continuation of production methods used just prior to water flooding.

Thrall-McKee Consolidated Water Flood of Sinclair Oil & Gas Co.

The Thrall-McKee Consolidated water flood in the Bartlesville sand was started in 1949 with a pilot of six injection wells. Water supply was obtained from supply wells in the Douglas sand. Injection started in June 1949 and included 80 acres.

First expansion of the flood took in four more injection wells, adding 51 acres to the flood, and requiring the drilling of two additional supply wells. Ultimately, eight water-supply wells were drilled. Then, because further extension of the flood was planned, a fresh-water reservoir with 1,300,000-bbl. capacity was built.

Supply water is now obtained from three sources: Douglas sand, fresh water, and produced water. The water is gathered at a low point in the field, mixed, and filtered through a slow-sand filter from which point it is pumped to the injection wells by means of a centrifugal pump. Injection pressures on July 1, 1951, ranged from 0 to 290 psi.

To develop a reasonable flood pattern it was necessary to convert old producers and former gas-injection wells to input. New wells were drilled where it was possible to fill out patterns. The remaining gas-injection wells were converted to producers. The casing shoes in all old wells were cemented at the time of the water-flood development.

Pumping practices.—During the primary and gas-repressure periods, producing wells were pumped by powers and jacks. Individual pumping units are being installed for the water flood as rapidly as individual-well production warrants. The units were powered by gas engines initially but it has become necessary to replace these with electric motors as produced gas diminished. Four new tank batteries with pressure treaters and automatic routing valves were built to replace the old batteries. All storage is held under ½ to 3-oz. pressure.

In July 1951 the project had 70 oil wells, 57 water-input wells, with 5 former gas inputs yet to be converted to producers. A total of 628 acres are under flood.

Water-injection rates after fillup were determined principally by the acre-feet of sand. The daily average injection rate was 17,691 bbl. in June 1951. It has since exceeded 20,000 bbl. per day. The flood has, up to date, been an almost ideal project, having reacted according to plan except for minor deviations, most of which were self-explanatory. Production at the end of September 1951 was exceeding 2,500 bbl. per day.

Teter Unit Water Flood of Cities Service Oil Co.

The Teter unit has three leases with a total of 1,800 acres of which 1,130 acres are productive. At the present time the unit has 81 producing oil wells, 12 water-input wells, 4 water-supply wells and 10 gas-input wells. The field is being converted from a gas-repressuring project to a water-flood project.

Several companies were active in developing Teter pool in 1920. In 1937 the operators unitized the pool for gas-repressuring. In November 1947 the unit was partially converted to a water-flood project by converting nine oil wells to water input on a 20-acre five-spot pattern. Water supply was from four wells in the Douglas sand.

At the present time the unit is being developed as a water flood while maintaining gas repressuring in the areas not affected by water flood. As the water-flood area is expanded gas repressuring will be discontinued.

Development.—The Teter water flood is being developed on a 20-acre five-spot pattern except in certain places on outside lines where 10-acre five-spots will be drilled. Oil wells are converted to input by cementing the 7-in. casing, shooting, and cleaning out. Water supply originally was from four wells in the Douglas sand. This sand failed to produce the required amount of water necessary for flooding. An earthen dam with 1,600,-000-bbl. capacity was then constructed with a pump station and filter plant to increase the water supply. Normal rainfall of 33 in. will provide 12,351,000 bbl. of runoff to the reservoir per year.

The filter-plant system as it now stands is capable of delivering 10,000 bbl. of water per day. Centrifugal pumps boost fresh water from the lake to the filter plant where it is treated in a 1,600-bbl. wood tank. Salt water from tank batteries is gravitated to a 1,400-bbl. tank where it is aerated and mixed with the fresh water. The water then gravities through eight open-type filters to a sump where high-pressure pumps pump the water to the input wells at 650-750-psi. pressure.

STATISTICAL INFORMATION

Oil produced to January 1, 1947, bbl.	1,329,607
Estimated increase due to gas repressuring, bbl.	619,617
Date of first water input	Nov. 1947
Number input wells July 1951	12
Number gas-input wells in operation	10
Present daily gas input to sand, M.c.f./day	499
Daily water input—bbl./day	5,360
Daily production of oil before water flood	277
Daily production oil, July 1951	482
Accumulative increased oil due to water flood, bbl.	100,248
Sand thickness, ft.	21-50

Polhamus Water-Flood Unit of Sohio Petroleum Co.

The Sohio Petroleum Co.'s Polhamus water-flood unit consists of five leases totaling 960 acres and is located in Sections 4, 27, and 34, T24 and 25s-9e, Greenwood County, Kansas. About 190 acres are affected by the flood, development of which has been spread over approximately 3 years. Production is from the Bartlesville sand which is found at an average depth of about 2,250 ft.

Reservoir characteristics.—Average net sand thickness is approximately 31 ft. Core analyses have been made on all new wells. From these, the reservoir was found to have an average permeability of 31 md. and an average porosity of 18 per cent. The productive part of the sand is underlain by water at an average ele-

(Continued on page 74)

NATURAL GAS IS THE FUEL for this International U-9 engine, running a 64-inch stroke, 22-stroke-per-minute pump. Superintendent Boyd has fifteen International power units in this mountainside oil field. He likes their endurance and reliability, backed up by International service facilities all through the oil fields.

A PIP FOR PUMPING

Rugged International engine found tops in high-producing California oil field

THE Brea Canyon Oil Company pumps a 40-well field on a California mountainside, and gets unusually high production by compressing the casing head gas and feeding it back into the wells to use over and over again.

All the engines but one in the field are Internationals, and—according to Superintendent A. L. Boyd—*"They run 24 hours a day, yet on our monthly checks, usually nothing more than an occasional fan belt replacement is necessary.*

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. . . Try Your Skill on Another of the Journal's Periodic "Oil and Gas Quizzes"

Prepared by Editorial Staff of The Oil and Gas Journal in collaboration with Prof. R. L. Whiting and Prof. G. L. Farrar, of the Petroleum and Chemical Engineering Departments, Texas A. & M. College.

How Are Your $1 and $64 Answers?—This test is to help Journal readers check their knowledge of a variety of the practical engineering and operating problems that are involved in modern petroleum operations. This miniature "refresher course" covers most of the important classifications involved.

This feature isn't a contest, no prizes will be given. Moreover, some people are going to get higher scores on some classifications, and make misses in others. But this quiz program has been drawn in accord with The Oil and Gas Journal's long-standing broad policy—to *broaden* and *assist* its readers in all phases of the petroleum industry, not to restrict them to narrow limits.

Very likely you'll enjoy this refresher course quiz feature. It's not too hard. As a matter of fact, this new Journal quiz program is really a game, for fun and professional stimulus.

Procedure for Quiz

There are two work sheets provided; use one for yourself and the other one for a friend who may wish to engage in this refresher check-up with you. Use these work sheets in marking your replies and scoring—don't make marks opposite the printed questions. After completing the test, the correct answers will be found on page 74, where you can check your replies.

Remember—no peeking. This quiz test is given under the Honor System.

How to Score

For each test question, there are up to five possible answers. From the different possibilities, the correct answer should be selected and its number placed on the answer sheet next to the number of that question. Example:

> **Question No. 0.**—The paraffin hydrocarbons are the most predominant series occurring in natural gas. Only one of the following is not a paraffin hydrocarbon:
>
> 1. Methane
> 2. Ethane
> 3. Propane
> 4. Butane
> 5. Cetane

The correct answer for Question 0 is **cetane** and the number **5** has already been placed at the right of **0** on the answer sheet. All of the questions on these pages are based on material which has appeared in The Oil and Gas Journal. For convenience the exact Journal references are given on the answer sheets.

EXPLORATION

Questions No. 1-13

Write down on the answer sheet the name of the basin (right column) which is associated with the producing formation listed in the left column.

1. Spraberry	**Permian basin** (eastern platform)
2. Dornick Hills-Springer	**Alberta**
3. Tertiary-Green River	**Appalachians**
4. Devonian reefs	**Los Angeles** basin
5. Hoxbar granite wash	**Midland** basin
6. Oriskany	**Julesburg** basin
7. Permo-Pennsylvanian reefs	**Uinta** basin
8. Graneros	**Gulf Coast**
9. Eocene-Wilcox	**Powder River** basin
10. Dundee	**Anadarko** basin (southwest flank)
11. Shannon	**Michigan** basin
12. Repetto	**Illinois** basin
13. Chester sands	**Ardmore** basin

Question No. 14

The Central Kansas uplift has also been known as the

1. Las Animas arch
2. Nemaha granite ridge
3. Bourbon arch
4. Barton arch
5. Chautauqua arch

Question No. 15

The Sioux uplift is associated with the

1. Permian basin
2. Big Horn basin
3. Michigan basin
4. Anadarko basin
5. Williston basin

Question No. 16

In the Four Corners area there is a cluster of three basins. Select the correct three from this list:

1. Marfa basin
2. Black Mesa basin
3. Uinta basin
4. Salina basin
5. Paradox salt basin
6. Anadarko basin
7. Plainview basin
8. Bellingham basin
9. San Juan basin
10. Ventura basin

Question No. 17

Which five of the following basins have unmetamorphosed sedimentary sections over 20,000 ft. thick?

1. Arkansas-Oklahoma Coal basin
2. Williston basin
3. Anadarko basin
4. Plainview basin
5. Ventura basin
6. Salina basin
7. Eastern Interior basin
8. Green River basin
9. San Juan basin
10. Uinta basin

Question No. 18

The largest oil field in the United States has an estimated ultimate oil recovery of:

1. 5 million barrels
2. 50 million barrels
3. 5 billion barrels
4. 500 million barrels
5. 1 million barrels

Question No. 19

Per acre oil recoveries in the Los Angeles basin have run as high as:

1. 100,000 bbl.
2. 500,000 bbl.
3. 1,000,000 bbl.
4. 50,000 bbl.
5. 25,000 bbl.

Question No. 20

An acre-foot of volume is equal to:

1. 1,001 bbl.
2. 10,567 bbl.
3. 5,677 bbl.
4. 7,759 bbl.
5. 1,776 bbl.

Question No. 21

Which one of the following statements is false?

1. Radioactivity logs can assist in detecting the presence of oil or gas.
2. Seismic depth calculations are subject to error.
3. Dip and strike of subsurface formations

can be determined from a single well bore.
4. The torsion balance is not accurate enough for modern exploratory methods.
5. On an electric log of a sand, high resistivities usually indicate the presence of oil.

DRILLING

Question No. 1

The cable-tool method and the rotary-drilling method are employed in drilling wells. The percentage of wells drilled by the cable-tool method during 1950 was approximately:

1. 0.2 per cent
2. 2.0 per cent
3. 20 per cent
4. 50 per cent

Question No. 2

All but one of the following are included in the normal mud-circulating system of a rotary-drilling rig:

1. Slush pump
2. Stand pipe
3. Rotary hose
4. Hook
5. Kelly

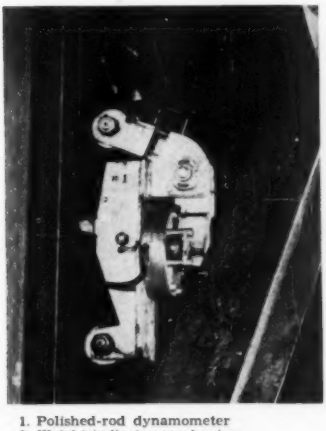
Question No. 3

All but one of the following are a part of the drilling string employed in the rotary method of drilling:

1. Drill pipe
2. Stand pipe
3. Drill collars
4. Kelly
5. Bit

Question No. 4

The unit shown in the accompanying picture is:



1. Polished-rod dynamometer
2. Weight-indicator mechanism
3. Well-surveying instrument
4. Motion-picture camera

Question No. 5

Periodic testing is necessary to maintain the properties of drilling fluids used in rotary drilling. One of the following tests is not ordinarily made in routine field testing of drilling fluids:

1. Viscosity
2. Density
3. Water loss
4. Sand content
5. Solids concentration

Here Are Work Sheets for Your Answers

INSTRUCTIONS: Clip out one of the work sheets below. If you are doing this with a friend, tear out one work sheet apiece. Then turn back to the start of the quiz, and commence. Mark your answers on the spaces in these work sheets. Then turn to page 74 to check your efforts against the correct answers.

WORK SHEET NO. 1

EXPLORATION

Ques. 1 ..... Ques. 12 .....
Ques. 2 ..... Ques. 13 .....
Ques. 3 ..... Ques. 14 .....
Ques. 4 ..... Ques. 15 .....
Ques. 5 ..... Ques. 16 .....
Ques. 6 ..... Ques. 17 .....
Ques. 7 ..... Ques. 18 .....
Ques. 8 ..... Ques. 19 .....
Ques. 9 ..... Ques. 20 .....
Ques. 10 ..... Ques. 21 .....
Ques. 11 .....

DRILLING

Ques. 1 ..... Ques. 10 .....
Ques. 2 ..... Ques. 11 .....
Ques. 3 ..... Ques. 12 .....
Ques. 4 ..... Ques. 13 .....
Ques. 5 ..... Ques. 14 .....
Ques. 6 ..... Ques. 15 .....
Ques. 7 ..... Ques. 16 .....
Ques. 8 ..... Ques. 17 .....
Ques. 9 .....

PRODUCTION

Ques. 1 ..... Ques. 11 .....
Ques. 2 ..... Ques. 12 .....
Ques. 3 ..... Ques. 13 .....
Ques. 4 ..... Ques. 14 .....
Ques. 5 ..... Ques. 15 .....
Ques. 6 ..... Ques. 16 .....
Ques. 7 ..... Ques. 17 .....
Ques. 8 ..... Ques. 18 .....
Ques. 9 ..... Ques. 19 .....
Ques. 10 .....

NATURAL GASOLINE

Ques. 1 ..... Ques. 8 .....
Ques. 2 ..... Ques. 9 .....
Ques. 3 ..... Ques. 10 .....
Ques. 4 ..... Ques. 11 .....
Ques. 5 ..... Ques. 12 .....
Ques. 6 ..... Ques. 13 .....
Ques. 7 ..... Ques. 14 .....

REFINING

Ques. 1 ..... Ques. 7 .....
Ques. 2 ..... Ques. 8 .....
Ques. 3 ..... Ques. 9 .....
Ques. 4 ..... Ques. 10 .....
Ques. 5 ..... Ques. 11 .....
Ques. 6 ..... Ques. 12 .....

PIPE LINES

Ques. 1 ..... Ques. 6 .....
Ques. 2 ..... Ques. 7 .....
Ques. 3 ..... Ques. 8 .....
Ques. 4 ..... Ques. 9 .....
Ques. 5 .....

WORK SHEET NO. 2

EXPLORATION

Ques. 1 ..... Ques. 12 .....
Ques. 2 ..... Ques. 13 .....
Ques. 3 ..... Ques. 14 .....
Ques. 4 ..... Ques. 15 .....
Ques. 5 ..... Ques. 16 .....
Ques. 6 ..... Ques. 17 .....
Ques. 7 ..... Ques. 18 .....
Ques. 8 ..... Ques. 19 .....
Ques. 9 ..... Ques. 20 .....
Ques. 10 ..... Ques. 21 .....
Ques. 11 .....

DRILLING

Ques. 1 ..... Ques. 10 .....
Ques. 2 ..... Ques. 11 .....
Ques. 3 ..... Ques. 12 .....
Ques. 4 ..... Ques. 13 .....
Ques. 5 ..... Ques. 14 .....
Ques. 6 ..... Ques. 15 .....
Ques. 7 ..... Ques. 16 .....
Ques. 8 ..... Ques. 17 .....
Ques. 9 .....

PRODUCTION

Ques. 1 ..... Ques. 11 .....
Ques. 2 ..... Ques. 12 .....
Ques. 3 ..... Ques. 13 .....
Ques. 4 ..... Ques. 14 .....
Ques. 5 ..... Ques. 15 .....
Ques. 6 ..... Ques. 16 .....
Ques. 7 ..... Ques. 17 .....
Ques. 8 ..... Ques. 18 .....
Ques. 9 ..... Ques. 19 .....
Ques. 10 .....

NATURAL GASOLINE

Ques. 1 ..... Ques. 8 .....
Ques. 2 ..... Ques. 9 .....
Ques. 3 ..... Ques. 10 .....
Ques. 4 ..... Ques. 11 .....
Ques. 5 ..... Ques. 12 .....
Ques. 6 ..... Ques. 13 .....
Ques. 7 ..... Ques. 14 .....

REFINING

Ques. 1 ..... Ques. 7 .....
Ques. 2 ..... Ques. 8 .....
Ques. 3 ..... Ques. 9 .....
Ques. 4 ..... Ques. 10 .....
Ques. 5 ..... Ques. 11 .....
Ques. 6 ..... Ques. 12 .....

PIPE LINES

Ques. 1 ..... Ques. 6 .....
Ques. 2 ..... Ques. 7 .....
Ques. 3 ..... Ques. 8 .....
Ques. 4 ..... Ques. 9 .....
Ques. 5 .....

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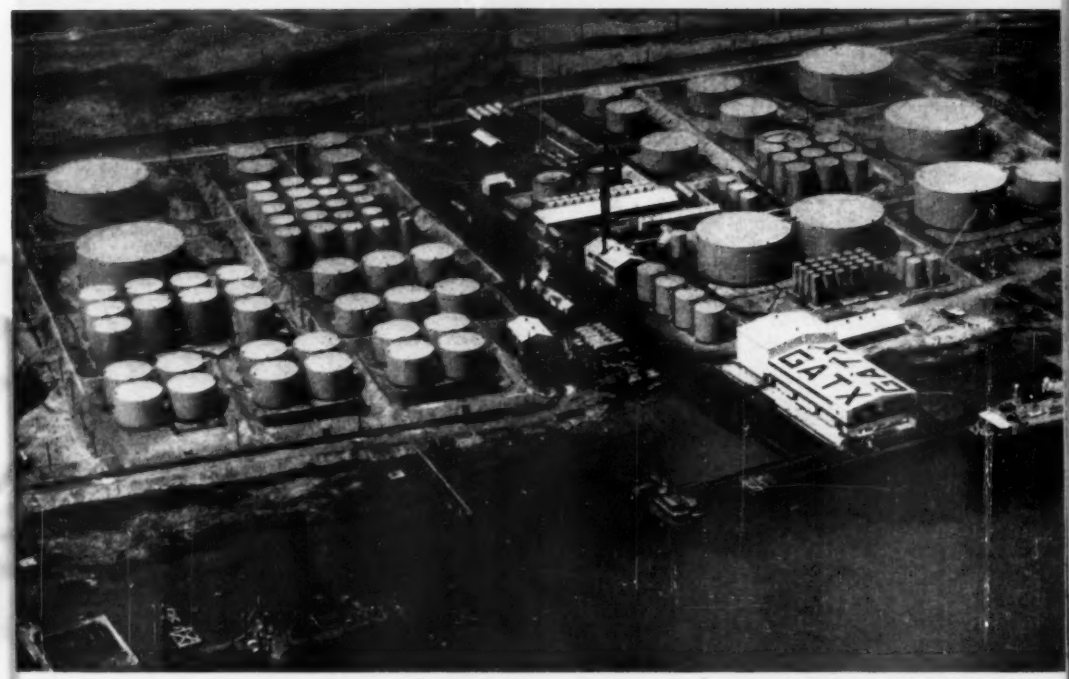

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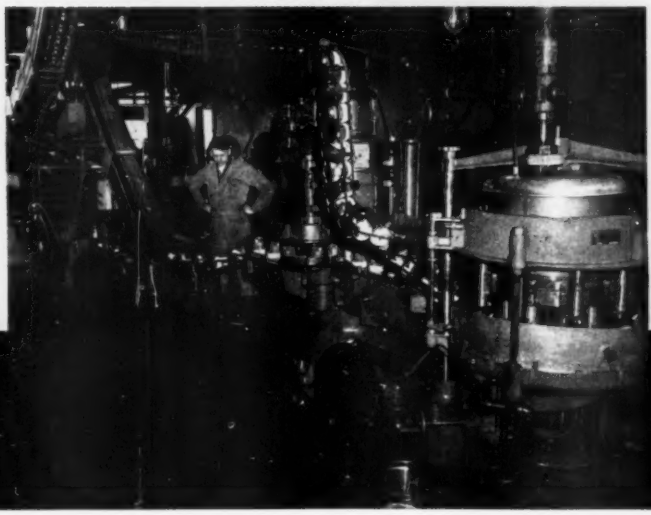

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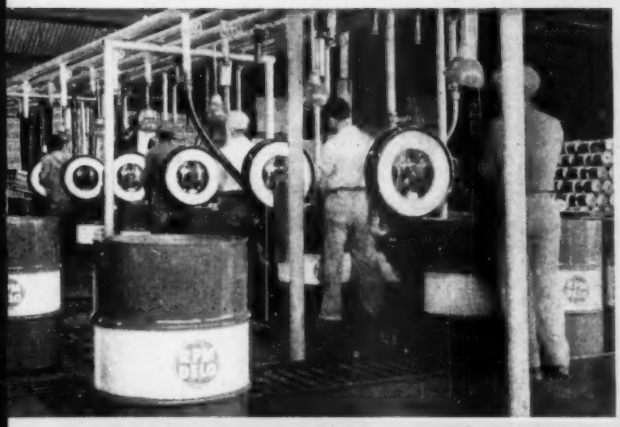

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OIL AND GAS QUIZ

Question No. 6

One of the following pieces of equipment is not ordinarily used in the conventional method of cementing oil-well casing:

1. Cementing head
2. Float collar
3. Drill collar
4. Float shoe
5. Cementing plugs

Question No. 7

All but one of the following materials are added to portland cements to provide special-type cements for oil-field use:

1. Calcium chloride
2. Sodium bentonite
3. Gypsum
4. Fibrous material
5. Magnesium sulfate

Question No. 8

In order to fulfill the requirements of oil-field applications a number of grades of casing are available for use. All but one of the following are grades of A.P.I. approved casing:

1. F-25
2. H-40
3. J-55
4. L-70
5. N-80

Question No. 9

In order to set long strings of heavy casing on bottom the casing string is frequently "floated in" with a float shoe on the bottom of the string. Ordinarily under these conditions one of the following is the most critical:

1. Tension
2. Bursting
3. Collapse
4. Torsion

Question No. 10

In order to land long, heavy casing strings on the bottom of the hole it may be necessary to do all but one of the following:

1. Float the casing
2. Use a graduated-weight string
3. Increase the density of the mud
4. Use smaller-diameter casing with thicker walls

Question No. 11

The more recent developments in jet rock bits have indicated that the rate of penetration generally increases for all but one of the following conditions:

1. Increase in circulation rate
2. Increase in fluid nozzle velocity
3. Decrease in rotary speed
4. Increase in weight carried on the bit

Question No. 12

All but one of the following are ordinarily employed when a well bore is intentionally deflected:

1. Single shot
2. Whipstock
3. Knuckle joint
4. Pilot reaming bit
5. Drill collar

Question No. 13

Wash pipe, overshots, impressions blocks, and milling tools are employed in one of the following operations:

1. Keyseating
2. Catheading
3. Fishing
4. Spudding
5. Cementing

Question No. 14

In the event lost circulation problems develop while drilling, observance of all but one of the following will, in many cases, minimize the probability of continued lost-circulation problems:

1. Maintain low mud viscosity
2. Maintain low circulation rates
3. Maintain high mud density
4. Maintain low circulation pressure
5. Maintain low mud density

Question No. 15

If a 240,000-lb. dead hook load is being lifted with an eight-working-line system using the conventional live line and dead-line arrangement the total load on the derrick is approximately:

1. 120,000 lb.
2. 240,000 lb.
3. 300,000 lb.

Question No. 16

Many requirements have been cited for an effective safety program. Probably the most important of these is one of the following:

1. A capable safety engineer
2. Periodic safety meetings and inspections
3. Safety consciousness on the part of all supervisory personnel
4. Proper first-aid facilities
5. Elimination of mechanical hazards

Question No. 17

All but one of the following are parts of a cable-tool drilling rig:

1. Knuckle post
2. Jack post
3. Crown pulley
4. Crank
5. Monkey board

PRODUCTION

Question No. 1

The crude-oil productivity of wells completed in limestone and dolomitic formations can ordinarily be increased by acidization. Only one of the following statements on the subject of acidization is not true:

1. Approximately 15 per cent hydrochloric acid is used.
2. Corrosion inhibitors are added to the acid.
3. Wetting agents are added to the acid.
4. The higher the bottom-hole temperature the faster is the rate of reaction between the acid and the limestone.
5. The higher the bottom-hole pressure the faster is the rate of reaction between the acid and the limestone.

Question No. 2

The accumulation of paraffin in tubing and lead lines from wells has presented a time-consuming and expensive maintenance problem. All but one of the following have been employed to remove paraffin from tubing and lines:

1. Injection of hot water and steam
2. Injection of solvents such as casing-head gasoline, pentane, and light gas oil
3. Use of soluble and insoluble plugs
4. Use of knives, hooks and scrapers
5. Recirculation of crude-oil production

Question No. 3

Field and laboratory equipment has been developed to determine the capillary properties of core samples. The so-called "capillary pressure cells" are employed to obtain data that are most useful for estimating one of the following:

1. Porosity
2. Permeability
3. Connate water content
4. Gas saturation
5. Oil density

Question No. 4

Corrosion of surface and subsurface equipment may be relatively little up to a certain time and then suddenly it becomes a major problem. Corrosion will be accelerated by all but one of the following conditions:

1. An increase in temperature
2. An increase in flow rate
3. An increase in concentration of the corrosive element
4. Decrease in oxygen or exposure to air
5. Increase in stress or stress reversals of the materials

Question No. 5

Many cycling operations have been instituted in gas-condensate fields to increase the ultimate hydrocarbon recovery. All but one of the following are useful in determining the recovery in a particular case:

1. Retrograde condensation loss
2. Reservoir analyzer and model studies
3. Reservoir "wet gas" volume
4. Sweep efficiency
5. Productivity index

Question No. 6

Electrification of leases in one West Texas field producing from a depth of 4,700 ft. has resulted in pumping power costs as low as:

1. $1.08 per barrel
2. $0.108 per barrel
3. $0.0108 per barrel
4. $0.00108 per barrel

Question No. 7

A large amount of the oil produced in this country is in the form of an emulsion. All but one of the following are necessary for the formation of a stable emulsion:

1. An emulsifying agent must be present.
2. The liquids must be immiscible.
3. There must be sufficient agitation to disperse one liquid as droplets in the other.
4. There must be a large volume of one of the liquids and a relatively small volume of the other liquid.

Question No. 8

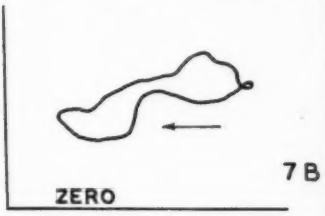
If a crude oil is highly undersaturated with natural gas at a given pressure and temperature and the pressure on the oil is reduced slightly, maintaining the temperature constant, all

but one of the following physical characteristics changes of the fluid will be observed:

1. Viscosity will decrease.
2. Gas solubility will increase.
3. Formation volume factor will increase.
4. Density will decrease.

Question No. 9

The analysis of dynamometer cards has been useful in reducing maintenance costs on pumping wells. The pumping problem represented by this dynamometer card is recognized as:



1. Excessive rod friction
2. Fluid pound
3. Tubing slack
4. Sucker rod break

Question No. 10

Oil-field pumping units are ordinarily counterbalanced in order to more nearly equalize the loads and torques on the upstroke and downstroke. The effectiveness of the counterbalance may be checked by all but one of the following:

1. Clutch slipping
2. Recording tachometer
3. Recording wattmeter
4. Determining polished-rod loads

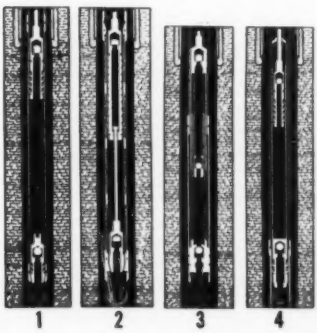
Question No. 11

The most recent development in the hydraulic pumping method is known as the "free pump." This improvement is best described by one of the following:

1. A frictionless positive displacement pump
2. A sucker-rod-operated pump
3. A submergible centrifugal pump
4. A pump that can be installed and removed without pulling the tubing
5. A pump actuated by hydraulic power from the surface

Questions Nos. 12-15

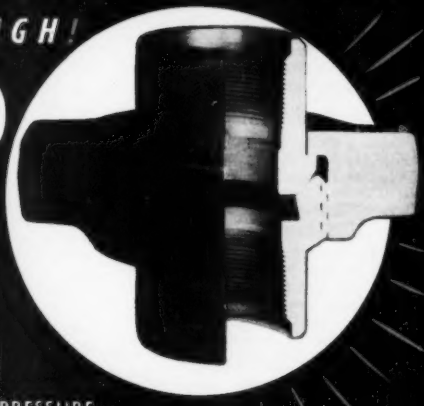
Many different types of subsurface oil well pumps have been used to lift crude oil (see drawings below).

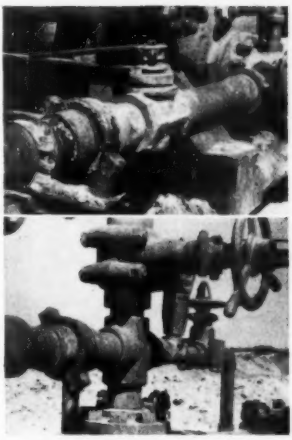


Where PRESSURES ARE HIGH — Where CLEARANCES ARE LIMITED — Where JOBS ARE ROUGH!

WECO FIG. 602 UNION

6000 LBS. TEST PRESSURE





Four inch, 6,000 lb. WECO Fig. 602 UNIONS on a mud pump discharge line. Their fast make-up, easy break-out and perfect sealing make them the ideal union for this service.

Extraordinary strength and compactness, plus a resilient seal ring to protect the metal-to-metal seat against abrasive and corrosive line fluids makes WECO FIG. 602 UNION the most efficient solution to manifolding and close coupled connections on high pressure lines. Wall sections of the forged steel sub ends are shorter and stronger . . . the forged steel wing nut is tougher . . . the resilient seal ring has been proved in service up to 15,000 lbs. In addition, it has all the WECO features of perfect sealing, fast make-up, easy handling heavy acme threads. It is available in sizes 1" through 4" with sub ends threaded or bored for welding. Fig 602 is ideal for welded installations, since the resilient seal ring can be replaced without cutting off the sub ends. Ask your Weco Representative for further information about the Fig. 602. ALWAYS ASK YOUR SUPPLY STORE FOR WECO UNIONS.

WECO

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Exclusive Sales Representative Outside Mid-Continent Area
CHIKSAN COMPANY
Brea, Calif. Chicago 3, Ill. Newark 2, N. J.
Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. Newark 2, N. J.

Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

Question No. 12

Which numbered pump is the "insert pump with seating cups forced into old working barrel"?

Question No. 13

Which numbered pump is of the design "concentric tubes, and fixed standing valve"?

Question No. 14

Which numbered pump is a "common working barrel"?

Question No. 15

Which numbered pump is a "sectional liner barrel, grooved metal plunger and garbutt rod"?

Question No. 16

One of the most recent developments to increase the productivity of a well is the hydraulic fracturing process. All but one of the following apply to this process:

1. A highly viscous fluid is used.
2. A high hydraulic pressure is required.
3. The viscous fluid must be clean and free of all insoluble material.
4. A gel breaker is used.

Question No. 17

Numerous methods have been suggested for stabilizing the crude-oil production from a well. The method in which the pressure is successively lowered in adjacent separators is known as stage separation. All but one of the following conditions are produced as a result of stage separation:

1. Increased oil and gas recoveries
2. Increased gas delivery pressure
3. Decreased total gas-oil ratio
4. Decreased stock-tank crude-oil gravity

Question No. 18

Hydrocarbon mixtures produced in the field may contain impurities which must be removed prior to transportation or sale. The soda ash, phenolate, tripotassium phosphate, amine, and iron oxide processes are employed to remove:

1. Hardness of water
2. Hydrogen sulfide from natural gas
3. Iron and red color from waters employed in water flooding
4. Liquid hydrocarbons from natural gas

Question No. 19

Increased application of secondary-recovery methods to oil recovery has focused attention on associated problems. In water flooding, control of properties of the injected water is important. All but one of the following statements concerning flood water treatment are correct:

1. Settling is used to remove inert materials.
2. Skimming and filtering are employed to remove entrained oil.
3. Alum and lime are added to precipitate iron and calcium carbonate.
4. Aeration is produced to oxidize the water and also to release dissolved natural gas.
5. Chlorine is added to the water to increase bacterial action.

NATURAL GASOLINE

Question No. 1

The grade of natural gasoline is specified by two numbers, such as 18-55. The meaning of these numbers, in sequential order, is respectively:

1. Ranges of 50 per cent boiling point at 140° F.
2. Barometric corrections for the 140° F. point
3. Maximum Reid vapor pressure-minimum percentage evaporated at 140° F.
4. Octane-number spread
5. Minimum percentage evaporated at 140° F.—maximum Reid vapor pressure

Questions Nos. 2-7

In the following table are a number of terms often used in the natural-gasoline industry. Some of these terms are identified in the statements below. Write on the work sheet (opposite the number of each question) the letter identifying the term which correctly describes the statement below:

Table of Terms

A. Casing-head gasoline
B. Rich oil
C. Lean oil
D. Raw gasoline
E. Retrograde condensate (or distillate)
F. Propanizer
G. Adsorber
H. Dehydrator
I. Absorber
J. Vapor stripper
K. Reabsorber

Question No. 2

This liquid is produced by decreasing the pressure on a rich gas under high pressure.

Question No. 3

Unstabilized natural gasoline.

Question No. 4

This stream is removed as bottoms from the stripper.

Question No. 5

This is a rich-oil fractionator-absorber having for its purpose the replacing of methane and ethane in the rich oil with higher components.

Question No. 6

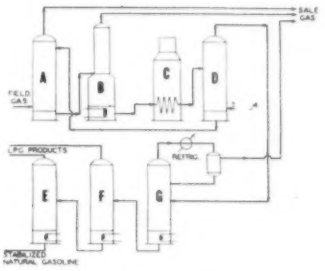
This piece of equipment provides for the removal of natural gasoline from the absorption oil by passing heated methane and ethane through the column.

Question No. 7

In this piece of equipment, gas flashed off from the rich oil is contacted with lean oil.

Questions Nos. 8-14

This is a simplified flow sheet for a natural-gasoline processing plant. On this diagram, identified in the statements below, is represented some of the necessary equipment. Write on the work sheet (opposite the number of each question) the letter on the diagram which correctly describes the statements below:



Question No. 8

What lettered portion on the diagram represents the natural-gasoline absorber?

Question No. 9

The depropanizer column is shown by what letter?

Question No. 10

Which is the rich-oil demethanizer?

Question No. 11

Where is the steam stripping column?

Question No. 12

Which portion of the diagram shows the debutanizer column?

Question No. 13

What typifies the rich-oil heater?

Question No. 14

The deethanizer column is represented by what letter?

REFINING

Question No. 1

All but one of the following materials may be blended into motor gasoline to **increase** its octane number:

1. Thermally cracked gasoline
2. Tetraethyl lead
3. Refinery straightrun gasoline
4. Natural gasoline
5. Catalytically cracked gasoline

Question No. 2

In the atmospheric distillation of crude oil, the stock from which fuel oil will be manufactured is:

1. Removed as bottoms from the column
2. Taken overhead
3. Removed from the column as a vapor
4. Returned to the upper part of the column as side reflux
5. May be recovered as the most volatile fraction

Question No. 3

All but one of the following statements apply to the primary distillation of crude oil:

1. Side reflux is usually employed

2. Reboiler heat is provided by steam in enclosed coils.
3. One or more side streams may be removed from the column.
4. The feed is heated to a high temperature and flashed into the column
5. Stripping steam is usually used

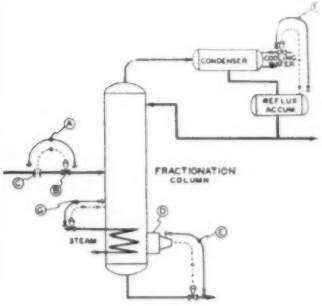
Question No. 4

Various improvements have been made recently in refining motor oils. A very desirable property in a motor oil is:

1. High sulfur content
2. High content of suspended carbon
3. Low viscosity index
4. High viscosity index
5. High volatility

Questions Nos. 5-8

On this diagram are schematically represented some of the elements necessary for fractionator control.



Write on the work sheet (opposite the number for each question) the letter on the diagram which correctly describes the statements below:

Question No. 5

A temperature control system is represented by this section of the flow sheet.

Question No. 6

A pressure control setup is depicted on this portion of the diagram.

Question No. 7

This schematic representation is of an orifice meter.

Question No. 8

This portion of the control system represents a liquid level indicator.

Question No. 9

Routing of fluids through a shell-and-tube heat exchanger is based on various factors. In the examples given below, the designated fluid should (in general) be on the tube side, in **all but one** application.

1. Vapor containing uncondensable gases
2. Fluid where pressure drop must be as low as possible
3. High-pressure fluid
4. Hottest fluid
5. Corrosive stocks

Question No. 10

Cooling-tower maintenance is necessary to insure a continuous, adequate supply of cooling water. It is recommended that a continuous blow down be employed to:

1. Control pH of the cooling water
2. Reduce algae formation
3. Reduce chlorine requirements
4. Decrease required cleaning
5. Reduce salt content of the cooling water

Question No. 11

Corrosion of refinery equipment due to hydrogen sulfide is a serious problem when refining certain crudes. It is particularly serious when:

1. Asphalt base crude is refined.
2. High-gravity crude is being handled.
3. Transfer lines are coated with cement or plastic.
4. Processing temperatures reach 650°-700° F., or higher.
5. Processing under pressure

Question No. 12

Corrosion inhibition with chromates has been practiced for some time in the refining industry. From a chemical standpoint the corrosion-inhibiting value of a soluble chromium compound is determined by:

1. The amount of hexavalent chromium (yellow or red in color) present
2. Velocity of circulation of the water containing the compound
3. The total amount of chromium in solution
4. The other elements in chemical combination with chromium
5. The presence of chromium compounds which are green in color

PIPE LINES

Question No. 1

All but one of the following represent important pipe-line-construction developments during the past 5 years:

1. Smooth bending of large-diameter pipe
2. Automatic submerged arc welding for right-of-way double jointing
3. Application of internal lineup clamps
4. Introduction of long-distance electric welded bell and spigot pipe lines
5. X-raying of welds on large-diameter pipe-line construction

Question No. 2

In commencement of a new long-distance pipe-line construction project, which of these pipe-line-construction steps comes first in order of execution:

1. Pipe handling and stringing
2. Ditchings and stream crossings
3. Transportation analysis and reconnaissance survey
4. Obtaining right-of-way and clearing
5. Design plans, specifications, bids

Question No. 3

One of the following is a brand-new engineering development, but is associated only with a certain natural-gas pipe-line operation:

1. Microwave relay communication system
2. Photographic records of pipe-line-construction progress
3. Gas-turbine prime mover in station
4. Electronic locators for buried lines
5. Radioactive isotope tracers

Question No. 4

Electromagnetic units recently have been successfully tested by Magnolia Pipe Line Co. for:

1. Cleaning new lines before use
2. Fishing out inaccessible loose parts in repair jobs
3. Adjustable counterbalances
4. Alignment of backup rings
5. Filters on products pipe-line systems

Question No. 5

Which one of the following well-known computations for some phase of pipe-line operations includes a dimensionless "friction factor" in its usage?

1. Barlow's formula
2. Weymouth's formula
3. Bernoullis' theorem
4. Reynold's number
5. Orifice flow coefficient

Question No. 6

Electronic strain gages recently have been employed by one company, in connection with:

1. X-raying of welds
2. Temperature contractions on river-crossing spans
3. Alignment of diesel-engine crankshafts
4. Pressure measurements at pumping stations
5. Stresses set up in bending large pipe

Question No. 7

Concerning inspection of pipe-line welds, **all but one** of the following statements are true:

1. Weld itself always results in exactly same tensile strength as pipe proper.
2. Outward appearance of weld does not necessarily indicate soundness.
3. Most defects are due to poor workmanship in alignment and root bead welding.
4. Length of weld defect is not the only criterion of its deficiency. Shape and density must also be considered.
5. Radiographic inspector must be extremely observant of details and must be capable of ready analysis of radiographic indications.

Question No. 8

These four "Inches" designate some well-known pipe-line systems:

Biggest Inch, Toughest Inch, Steepest Inch, Little Big Inch

Is the majority of this list **now** transporting:

1. Natural gas, or
2. Petroleum liquids

Question No. 9

A new "giant rooter" or "plow" used by Lone Star Gas Co. in pipe-line construction is used to:

1. Tear out trees on right-of-way
2. Demolish concrete footings at abandoned facilities
3. Eliminate use of ditching machines
4. In rocky country, to run ahead of ditcher
5. Eliminate all rock blasting

. . . and Here Are the Answers

These are the correct answers for the Refresher-Quiz. Check your quiz work sheets against these.

EXAMPLE

Question Number	Correct Answer	Reference in The Oil and Gas Journal
0	5	Various

Question Number	Correct Answer	Reference in The Oil and Gas Journal
EXPLORATION		
1	Midland	Various
2	Ardmore	Various
3	Uinta	Various
4	Alberta	Various
5	Anadarko	Various
6	Appalachians	Various
7	Permian	Various
8	Julesburg	Various
9	Gulf Coast	Various
10	Michigan	Various
11	Powder River	Various
12	Los Angeles	Various
13	Illinois	Various
14	4	Various
15	5	Various
16	2, 5, 9	Various
17	1, 3, 5, 8, 10	Various
18	3	Various
19	3	Various
20	4	Various
21	4	Various
NATURAL GASOLINE		
1	3	Various
2	E	Apr. 20, 1950, p. 180
3	D	Apr. 20, 1950, p. 180
4	C	Apr. 20, 1950, p. 157
5	F	Apr. 20, 1950, p. 160
6	J	Apr. 20, 1950, p. 158
7	K	Apr. 20, 1950, p. 203
8	A	Apr. 20, 1950, p. 157
9	F	Apr. 20, 1950, p. 157
10	B	Apr. 20, 1950, p. 157
11	D	Apr. 20, 1950, p. 157
12	E	Apr. 20, 1950, p. 157
13	C	Apr. 20, 1950, p. 157
14	G	Apr. 20, 1950, p. 157
DRILLING		
1	3	Jan. 25, 1951, p. 185
2	4	Oct. 5, 1950, p. 171
3	2	Oct. 5, 1950, p. 171
4	2	Feb. 15, 1951, p. 76
5	5	Sept. 22, 1949, p. 266
6	3	Various
7	5	Various
8	4	July 26, 1951, p. 240
9	3	July 26, 1951, p. 240
10	4	July 26, 1951, p. 240
11	3	Mar. 30, 1950, p. 102
12	5	Sept. 22, 1949, p. 274
13	3	Sept. 22, 1949, p. 274
14	3	Apr. 12, 1951, p. 86
15	3	Various
16	3	Oct. 5, 1950, p. 230
17	5	Various
PRODUCTION		
1	5	Various
2	5	Various
3	3	Various
4	4	Various
5	5	Mar. 11, 1948, p. 106
6	3	July 12, 1951, p. 82
7	4	Various
8	2	Nov. 15, 1947, p. 347
9	2	Jan. 12, 1950, p. 67
10	4	Various
11	4	Various
12	4	Various
13	3	Various
14	1	Various
15	2	Various
16	3	Various
17	4	Nov. 3, 1949, p. 62
18	2	Feb. 2, 1950, p. 57
19	5	Feb. 22, 1951, p. 176
REFINING		
1	3	Various
2	1	Various
3	2	Various
4	4	Various
5	G	May 25, 1950, p. 161
6	F	Mar. 23, 1950, p. 351
7	C	Mar. 23, 1950, p. 351
8	D	May 25, 1950, p. 161
9	2	Mar. 2, 1946, p. 91
10	5	Apr. 1, 1948, p. 194
11	4	Oct. 21, 1943, p. 63
12	1	Jan. 13, 1949, p. 83
PIPE LINES		
1	4	Sept. 21, 1950, p. 191
2	3	Sept. 21, 1950, pp. 192-195
3	3	Various
4	5	Oct. 4, 1951, p. 231
5	4	Various
6	4	Oct. 4, 1951, p. 208
7	1	Oct. 4, 1951, p. 177
8	1	Various
9	4	Sept. 21, 1950, p. 316

Water Floods

(Continued from page 64)

vation of —998 ft., or a depth of 2,265 ft.

Original primary development of Polhamus pool began in 1923. Recovery by these means totaled 1,363,339 bbl. or approximately 7,000 bbl. per acre. Water flooding was started in May 1949. At the completion of the water-flood development, the unit will consist of 30 input wells, 26 producers, 3 Douglas-sand supply wells, and 2 Douglas disposal wells.

It has been a general practice to run 4½-in. casing in the input and 5½-in. pipe in the producing wells. Pipe is cemented at the top of the sand with 60 sacks. Producers were shot, although inputs were not as a general rule.

Closed water system.—Water for flooding is obtained from the Douglas sand at a depth of 1,200 ft. and is pumped with 30-hp. Reda pump. All produced water is disposed of in the Douglas. Both supply and produced water is kept air free; a closed-type system being used. Electrically driven centrifugal pumps are used for water injection.

To date, injection totals 2,033,485 bbl. of water and water-flood oil recovery totals 350,489 bbl. Current production is 750 bbl. oil daily and 1,500 bbl. water daily while input is 3,300 bbl. water daily at 220 psi. Production prior to flooding was 51 bbl. oil daily.

BOOKS

SECOND ANNUAL INSTITUTE ON OIL AND GAS LAW AND TAXATION. Published by Matthew Bender & Co., Albany, N. Y. 555 pp. $16.50.

This volume reports the proceedings of the institute sponsored by the Southwestern Legal Foundation last year. Important present-day problems of the oil and gas industry are discussed by a distinguished group of lawyers who are acknowledged authorities on specific phases of oil and gas law and taxation as it affects the oil and gas industry. These articles form the basis for the several lectures delivered during the 3-day session held at Dallas. As printed in this volume they have been expanded beyond their original lecture form and enjoy the advantage of footnote citations and other helpful addenda. The book should be a boon to the busy practitioner who finds it difficult to keep abreast of the rapid changes in the law.

THE CRISIS IN SULPHUR. By Langbourne M. Williams, Jr. 40 pp.

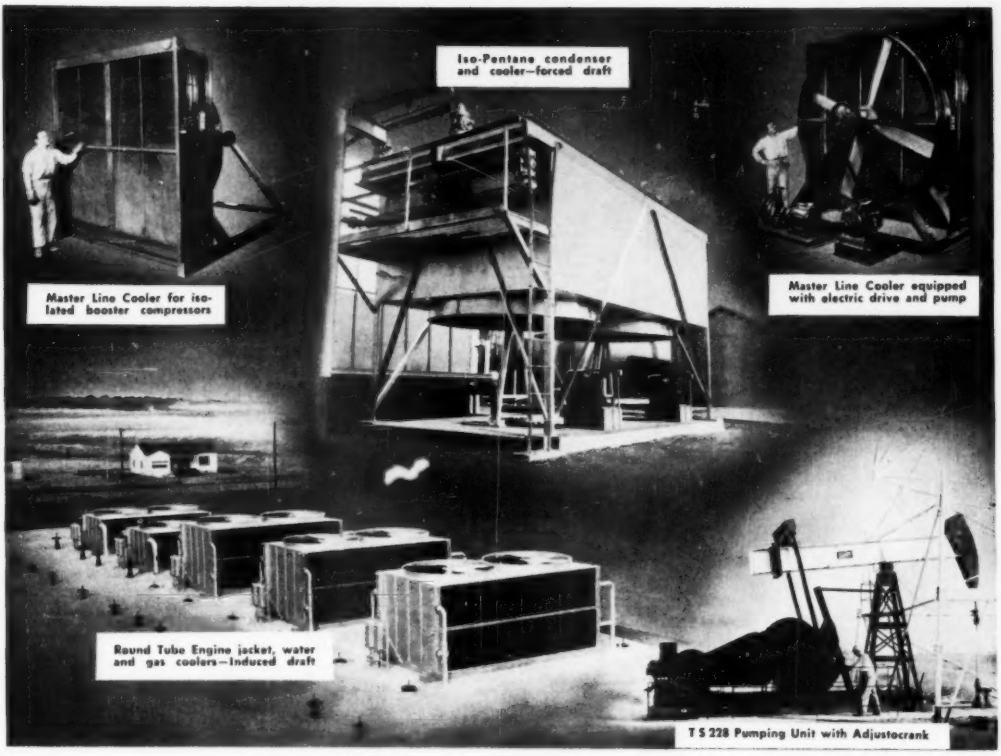
This is a report by the president of Freeport Sulphur Co. He states that although the long-range outlook is favorable, current production cannot meet the demand and as a result the United States faces a crisis in the coming months. The author points out that the Government has assumed complete control over the distribution of sulfur and that the sulfur producers no longer have freedom of action. Therefore, he adds, the Government must determine which users are more important to defense than others and must direct shipments accordingly. Many new projects to increase the supply are under way, he reports, but it will probably take 2 years or more for much of the new production to be realized.

THE BIG PLAY. By Elinor Prior. Published by McGraw-Hill Book Co., Inc., 330 West Forty-Second Street, New York. 454 pp. $3.75.

This is the story of Brock Catlin, a man who changed the direction of his driving ambition almost too late. Catlin lived by the "big play"—by risking his last dollar on a likely piece of land and gambling that it would bring in a great oil field. The novel comes out of the life of the Southwest, and of the oil men who fought the land and each other with a determination and violence that knew practically no limits. It is the story of a man who came close to tragedy because of the very excess of his own abilities, and was saved only because neither the life he had led nor the success he had won had destroyed his humor or his decency. Crowded with human drama and thrilling action, The Big Play is a novel about a part of the American scene that has needed a story as big and intense as this to do it justice.

LIFE AND DEATH OF AN OIL MAN. By John Joseph Mathews. Published by University of Oklahoma University Press, Norman. 259 pp. $3.75.

In this book is the story of one of the nation's greatest plungers in oil, Ernest Whitworth Marland, "a man who had the Midas touch and good luck unparalleled, until one day he lost them and, like thousands before him, plunged down the financial way to that peculiar disaster which awaits oil men whose luck (or insight) has changed." Marland had much in common with other acquisitive builders of an earlier period in the Age of Freedom—Jim Fisk, Daniel Drew, John D. Rockefeller, and Andrew Mellon. As the author describes him, he was their "equal in energy, in dreaming, in cleverness, and in acquisitive capacity, but his ruthlessness was vitiated by the fact he had been born a gentleman." The story traces the growth of the company Marland founded, through to its tragic chapter on an absorbing account of high finance and the eventual absorption of the fabulous Marland Oil Co. by Continental Oil Co.


Iso-Pentane condenser and cooler—forced draft
Master Line Cooler for isolated booster compressors
Master Line Cooler equipped with electric drive and pump
Round Tube Engine jacket, water and gas coolers—Induced draft
T S 228 Pumping Unit with Adjustocrank

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Wichita Falls ..... Texas
Wichita ..... Kansas

Fig. 1—(Left) Cutaway drawing of the Reed diamond core barrel and bit assembly.

Fig. 2—(Right) 8⅜-in. wire-line diamond head, one of several types successfully used with the wire-line barrel.

New Wire-Line Diamond Core Drill Saves Round-Trip Costs

by Haskins Hartwell*

THIS article describes the development and application of a new-type wire-line diamond core drill, which has turned in some outstanding runs during extensive field tests completed recently by major oil companies and drilling contractors. The tests have been run in the Texas Gulf Coast, East Texas, West Texas, North Texas, South Louisiana, Oklahoma, and Alberta, Canada.

In general, it has been found that the drilling characteristics of the wire-line diamond core drills are comparable to conventional diamond core drills. An important advantage, however, is the considerable saving in coring costs, which is a consequence of the fact that the need for round trips to remove cores is eliminated.

Description.—Fig. 1 is a cutaway drawing of the Reed wire-line diamond core barrel with bit assembly in place, and Fig. 2 is one of several types of diamond core bits which have been used with success. The bit and barrel are thus seen to be not dissimilar from conventional design, except in the respect that the bit is designed with a broad face to cut small diameter cores.

Diamond drilling.—It will be recalled that in certain hard-rock areas diamond coring has been advocated as a measure to achieve economical drilling. To minimize the cost of frequent round trips, attempts were made to develop extremely long core barrels. Various methods of breaking up the cored formation and washing it out with the mud stream by reverse circulation were also investigated. The data given here show that a wire-line core barrel should offer the same advantages in diamond core drilling that it does in conventional coring by roller and drag bits. On the other hand, before economy of wire-line diamond coring could be claimed, experience was needed to show the performance of the broader-faced diamond drills with regard to rate of penetration.

Results.—A special wire-line core barrel was developed and preliminary tests were run using several makes of diamond core drills. Findings were so encouraging that additional barrels were manufactured, similar to the one illustrated in Fig. 1. Table 1 shows some representative results obtained in the subsequent field testing of wire-line diamond coring.

Generally speaking, the tests indicated that wire-line diamond drills would penetrate at approximately the same rate and make approximately the same footage as conventional diamond core drills. This is an important finding, since drills of the type illustrated in Fig. 2, while cutting smaller-diameter cores, necessarily cut out more rock.

The advantage and associated saving of wire-line operations result, of course, from the elimination of round trips to recover cores. The saving has been variously estimated by some operators at from $2 to $8 per foot. The exact saving depends upon the depth of the hole and other factors; but in one particular case in the Texas Gulf Coast, a saving of approximately $7.50 per foot of core was obtained.

Other tests.—In West Texas, near Vincent, a 6¾-in. o.d., 1⅛-in. i.d. wire-line barrel was run by a major company. The barrel was run at approximately 4,300 ft. for the purpose of straightening the hole and to increase the rate of penetration. In this formation, conventional rock bits had been making from 1 to 1½ ft. per hour. The wire-line diamond barrel made as high as 4 ft. per hour. Because of the convenience afforded by the wire-line barrel in removing the cores without withdrawing the drill pipe, cores were pulled frequently ranging from 10 to 20 ft. Although no oil showing was expected at this depth, one of the cores pulled showed approximately 2 ft. of oil-bearing formation. Further cores showed approximately 32 ft. of oil sand, and in this way unsuspected commercially recoverable oil was discovered. In addition to the finding of an otherwise unknown producing zone in this field, which was made possible by economical continuous coring, the diamond barrel accomplished the original purpose of straightening up the hole and increasing the rate of penetration.

In certain formations such as the high angular shale fault encountered in the last test listed in Table 1, it was found that the core wedged in a conventional diamond barrel before a full-length core could be cut. Under the same conditions, the wire-

(Continued on page 81)

TABLE 1—REPRESENTATIVE CORING RUNS USING WIRE LINE DIAMOND CORE DRILLS

Bit size (in.)	Core dia (in.)	Footage cut	Per cent rec	Rate of penetration (feet per hour)	Formation
6¼*	1⅛	104	92.3	1.1 to 12.0—av. 4.0	Anhydrite, lime, dolomite
6¾	1⅛	134	80	1.7 to 4.3—av. 2.2	Lime, sand, dolomite, 20-30 per cent chert, hard shale
7⅝	2	156	85	Av. 3.0	Broken lime, hard sand
8⅜†	2	456	83.5	1.0 to 4.0—av. 3.0	Sand, shale, sandy shale
8¾‡	2	320	87.5	1.0 to 6.0—av. 3.0	Sandy shale, sand, shale

*Rock bits averaged 2.0 ft. per hour, and 6¼-in. conventional diamond bits averaged 3.5 ft. per hour in the same formation. †An 8⅜-in. conventional diamond bit averaged about the same in penetration, but the wire line feature saved 2 to 3 hours per 50 ft of core. ‡Conventional diamond core bits cut only from 3 to 10 ft. before formation wedged in barrel because of high angular shale fault. The wire line barrel cut full 10 ft of core, saving considerable round trip time.

*Engineer, Reed Roller Bit Co., Houston.

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Catalytic upgrading by Hydroforming

by Henry G. McGrath*

Gasoline production in this country during 1950 was at the rate of nearly 3,000,000 bbl. per day. Of this total 8 per cent was natural and 33 per cent was straightrun, while 34 per cent was obtained by thermal processing of various fractions from crude oil and 25 per cent was catalytic gasoline. A large portion of the straightrun is of low quality and the fraction of the thermal gasoline boiling above 250° or 300° F. is likewise of low octane. Something upwards of 1,000,000 bbl. per day is of poor quality and therefore is available for some form of catalytic upgrading. One of the new processes for catalytic upgrading is fluid hydroforming. This paper deals with the hydroforming reactions, fluid catalyst effect of operating variables as indicated by pilot plant data, and fluid hydroforming economies.

FOR many years thermal processing was the only method used for naphtha upgrading. During the middle 1930's the desulfurization and dehydrogenation reactions were being studied with gel-type catalysts in industrial and university laboratories. The objectives were twofold: first, to remove corrosive sulfur which reduced markedly the lead response of gasoline and increased refinery maintenance, and second, to produce olefins which had been shown previously to have better antiknock properties than paraffins.

Aromatics.—So much hydrogen was produced in experiments with such catalysts as chromium oxide gel and molybdenum oxide that these investigators were prompted to look for aromatics in the product. Aromatics were found to be there in high concentration. Olefins were present in low concentration. The catalysts deactivated quickly due to excessive carbon or coke deposition.

To make the process commercially attractive it was necessary to recycle tail gas rich in hydrogen and increase the pressure to such a point that the catalyst could be used for a considerable time, e.g., hours rather than minutes, without excessive carbon formation and gas production. The hydroforming process was born with the discovery of the effect of operating under substantial H_2 pressure.

Commercial plants.—Eight fixed-bed hydroformers were built before and during World War II. The first was a two-reactor unit of 7,500-bbl. per day capacity for Pan American Refining Corp. This unit went on stream in 1940. Subsequent units were built for Humble Oil & Refining Co., Continental Oil Co., Union Oil Co., The Texas Co., Standard Oil Co. (Ind.), Pure Oil Co., and the Standard Oil Co. of California. These plants—with the exception of Union's—were four-reactor units. Two reactors with intermediate reheat were employed in series on reaction while two were regenerating, purging, etc. The largest fixed-bed hydroformer was Humble's which was designed for a normal throughput of 16,500 bbl. per day and subsequently altered for a throughput of about 25,000 bbl. per day. During the war the hydroformers produced nitration-grade toluene and aromatic blending agents.

*Associate director, Petroleum and Chemical Research Laboratory, M. W. Kellogg Co., Jersey City. Abridgement of paper presented at sixth annual meeting, A.I.Ch.E., Galveston, October 1951.

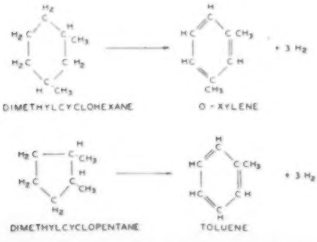

Fig. 1—Reactions occurring in hydroforming naphthenes.

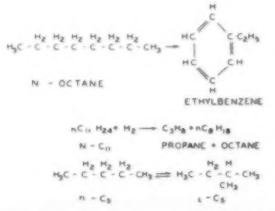

Fig. 2—Paraffin fractions obtained in hydroforming reaction.

Chemical Reactions and Equilibria

Feed-stock composition is of considerable significance in hydroforming. The more naphthenic stocks, especially those in which cyclohexane homologs predominate, will give the best yield-octane relationships and the highest aromatic yields. Typical fixed-bed pilot-plant data for Hastings, East Texas, and West Texas heavy naphthas are shown in Table 1.

TABLE 1—FIXED BED-HYDROFORMING MoO_3-Al_2O_3 CATALYST, 95 C.F.R.R. OCTANE, 10 LB. R.V.P.

Feed source:	Boiling range (°F.)	Yield (400° F. e.p.) vol. per cent
Hastings	272/407	92.4
East Texas	248/396	86.4
West Texas	244/408	85.7

The yields of 10-lb. R.v.p. 400° F.-e.p. gasoline of 95 research octane clear were 92.4 per cent for Hastings, 86.4 per cent for East Texas, and 85.7 per cent for West Texas. The Hastings stock contained the highest naphthene content (about 63 per cent) and gave the best results. The East Texas and West Texas heavy naphthas contained approximately 35 and 30 per cent naphthenes, respectively.

Hydroforming reactions.—These do not all occur at the same rate. For example, C_6 ring naphthene dehydrogenation proceeds very rapidly, whereas the conversion of paraffins to aromatics is very much slower. Likewise, side reactions with C_6 ring naphthenes are almost negligible, but such is not the case with paraffins.

Several reactions occurring in hydroforming are presented in Figs. 1, 2, and 3.

Reactions of naphthenes containing five and six-carbon-membered ring compounds are shown in Fig. 1. The conversion of dimethylcyclohexane to xylene and dimethylcyclopentane to toluene are typical.

In Fig. 2 reactions of paraffins are shown. The first reaction shown is dehydrocyclization of normal octane to ethyl benzene.

The second shows cracking of a normal paraffin (C_{11}) in the presence of hydrogen to form saturated hydrocarbons—propane and octane.

The third shows isomerization of paraffins—n-pentane to isopentane. The pentane fraction produced in hydroforming will normally contain approximately 60 per cent isopentane.

The reaction of a ring sulfur compound (a thiophene) is shown in Fig. 3. The thiophene compound in this case is shown reacting with molybdenum in the presence of hydrogen. Whether the sulfur is eliminated as a

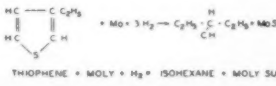

Fig. 3—Thiophene desulfurization in hydroforming reaction.

metal sulfide, as is shown here, and burned off during regeneration of the catalyst, or is eliminated directly as H_2S during the reaction period depends on pressure, catalyst, and catalyst holding time.

The extent to which the various reactions occur is a function of operating conditions, feed stock, and condition of catalyst.

Table 2 shows the equilibrium con-

TABLE 2—THERMODYNAMIC DATA, 900° F.

Compound—	pp H_2—atm.	Equil. conv. to aromatics (per cent)
n-Hexane	40	3
Methylcyclopentane	40	40
Cyclohexane	40	84
n-Hexane	10	86
Methylcyclopentane	10	95
Cyclohexane	10	99+

version of normal hexane, methylcyclopentane, and cyclohexane to benzene at hydrogen partial pressures of 40 atm. (about 600 psi.) and 10 atm. (135 psig.). Equilibrium conversion to benzene at 40 atm. is only 3 per cent for normal hexane, 40 per cent for methylcyclopentane, and 84 per cent for cyclohexane. On the other hand, when a hydrogen partial pressure of 10 atm. is employed, equilibrium conversion to benzene for normal hexane is 86 per cent, for methylcyclopentane 95 per cent, and for cyclohexane over 99 per cent.

The Catalyst

In the selection of a catalyst one of the chief considerations was to find one that was capable of synthesizing aromatics from paraffins and olefins as well as from naphthenes. It was reasoned that the hydrogenation-dehydrogenation oxide-type catalysts, such as molybdenum and chromium oxide, might possess suitable activity at temperatures well below those employed in thermal reforming. Initially tests were conducted in glass equipment at atmospheric pressure. It was discovered that a rugged catalyst could be made if the Group VI metal oxide were deposited on a support. The best support found for this reaction was alumina.

Interestingly enough, the chromium catalyst, which showed a marked superiority over molybdenum at atmospheric pressure, for dehydrocyclization of n-heptane, was inferior to the latter catalyst under substantial hydrogen partial pressure; consequently, the molybdena-alumina catalyst was used for hydroforming. The first commercial catalyst was made by impregnating a material, very similar to "activated alumina," with a molybdenum salt solution followed by drying and calcining at a temperature above 1,000° F.

Fluid catalyst.—Ultimately a catalyst comprising alumina gel as a support was used by most of the operators of fixed-bed hydroformers. For the development of fluid hydroforming one of the catalysts that has been used in a 3-bbl. per day pilot plant consisted of molybdena on a silica-stabilized alumina gel. Particle-size distribution of the catalyst before being placed in the fluid hydroformer and after 6 weeks' operation is shown in Table 3. In 6 weeks' time, in a

TABLE 3—FLUID HYDROFORMING, KELLOGG MoO_3-Al_2O_3 GEL CATALYST, TYPICAL PARTICLE SIZE ANALYSES

Roller analysis:	Charge catalyst	After 6 weeks operation
0-20 μ—wt. per cent	3	12
20-40	14	17
40-60	44	47
60+	39	24

completely closed system, the 0-20 μ fraction increased only from 3 per cent to 12 per cent. Apparently the catalyst has good attrition resistance.

Pilot data.—In the fluid hydroforming experiments conducted in the laboratory pilot plant no decline in catalyst activity has been observed. This is shown in Table 4 where the origi-

TABLE 4—FLUID HYDROFORMING CATALYST ACTIVITY TESTS

	Original fluid hydroformer charge	After 895 hours of operation in fluid hydroformer
Pressure, psig.	400	400
Temperature, °F.	930	930
Gasoline inspections:		
C_5/400 gasoline, octane—C.F.R.M.	82.3	83.1

nal fluid hydroformer charge is compared with catalyst that had been in use for 895 hours. The activity checks were made at a pressure of 400 psi. and a temperature of 930° F. In a small fixed-bed test unit the product quality was 82.3 octane C.F.R.M. before use and 83.1 after use.

A large volume of data has been compiled from the fluid hydroforming pilot plant mentioned above. These data show definite improvement over fixed-bed hydroforming from a yield standpoint. In Table 5, a yield comparison has been made for operation on 406° F. and 425° F.-e.p. Mid-Continent heavy naphthas. It can be seen that fluid hydroforming gave 2.3 volume per cent higher gasoline yields than the conventional fixed-bed process when producing 90 clear research octane gasoline. This comparison is based on 100 per cent C_5 recovery gasolines. Since the gasoline from the fluid operation was of lower vapor pressure an even more favorable picture would be possible for the fluid operation if the comparison were made on liquid product yields of a common vapor pressure.

THE AUTHOR

Henry G. McGrath is associate director, Petroleum and Chemical Research Laboratory, M. W. Kellogg Co., with whom he has been associated 14 years. He graduated from M.I.T. with a B.S. in 1936 and received his M.S. in chemical engineering practice the following year. Upon completion of his academic work he started his career with Kellogg as pilot-plant operator. He has worked on the improvement of hydroforming, fluid catalytic processing, and on the refinement of Kellogg's Synthol process for synthesizing liquid fuels from hydrocarbon gases. He has authored many technical papers on petroleum refining and chemical production and recovery and holds a number of patents in these fields.

TABLE 5—COMPARISON OF FIXED BED AND FLUID HYDROFORMING MID-CONTINENT NAPHTHA

	Fixed bed	Fluid bed
Feed—gravity, °A.P.I.	50.1	52.7
A.S.T.M. boiling range, °F.	203/406	208/425
Aniline point, °F.	136	137
Octane, C.F.R.R.	34	36
Gasoline (C_5/400):		
Octane, C.F.R.R.	90	90
Yield, vol. per cent	79.6	81.9

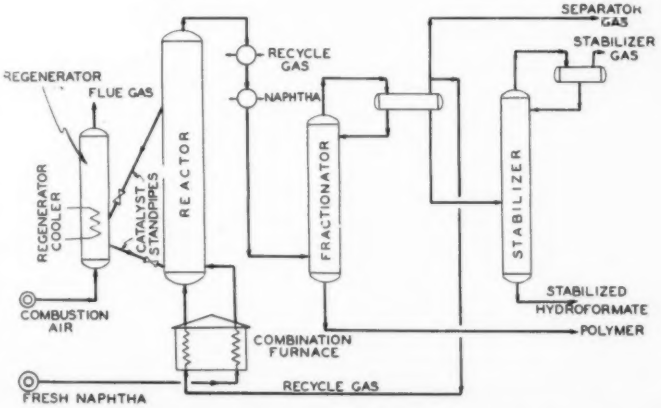

Fig. 4—Flow arrangement of fluid catalytic hydroforming process.

In the fixed-bed process the regeneration part of the plant represented about 40 per cent of the investment. It was necessary to keep the O_2 concentration of the inlet gas down to about 2 per cent. This entailed a tremendous quantity of expensive flue-gas recycling. Using this pilot plant, the catalyst has been regenerated successfully time and again with undiluted air at high pressure by charging air to a mixture of carbonized and uncarbonized catalyst. The importance of being able to regenerate with straight air is obvious.

Commercial Unit

A flow sheet for a commercial plant is shown in Fig. 4. Naphtha and recycle gas are preheated separately. The recycle gas is charged to the bottom of the reactor and the naphtha a little higher up. Spent catalyst flows down through a standpipe into the regenerator. Regenerated catalyst flows down through another standpipe, at a controlled rate, into a low point in the reactor. Spent catalyst is regenerated with air—straight air—and the regenerator is maintained at a constant temperature by a cooler installed in the regenerator. The recovery system is more or less conventional and requires no explanation.

Effect of Operating Variables

Several of the following tables and curves demonstrate the effect of certain operating variables.

Tail-gas recycle.—The importance of employing tail-gas recycle for this process is shown in Fig. 5 for some fixed-bed data obtained on an East Texas light naphtha many years ago. A MoO_3-Al_2O_3 catalyst was used in this program. The relationship between debutanized gasoline yield and C.F.R.M. octane number with circulating gas rate as the parameter is presented. The debutanized gasoline yield at 82 octane (C.F.R.M.) increased from 62 per cent at 900 cu. ft. per barrel to about 72 per cent at 2,600 cu. ft. per barrel and further to 75 per cent at 4,500 cu. ft. per barrel.

Soaking volume factor.—The effect of thermal reforming prior to the catalyst bed is shown in Fig. 6. This soaking factor is used as the criterion for determining the extent of thermal reforming. Soaking volume factor (S.V.F.) is defined as the cubic feet of furnace volume above 800° F. divided by the barrels per day of cold naphtha charged times the mean reaction rate in the preheater, transfer line, and empty space before the reaction mixture reaches the catalyst relative to a base temperature of 800° F.

These experiments were made at a pressure of 200 psi. and the catalyst contained MoO_3 as the active ingredient. The 100 per cent C. recovery gasoline yield at 78 octane (C.F.R.M.) increased from 82 volume per cent at a soaking volume factor of 11 to 86.3 volume per cent at a soaking volume factor of 0.5. Thermal reforming of the naphtha in the fluid process is reduced over the fixed-bed process since the large distribution space above the catalyst is eliminated. In the fluid bed the reacting vapors are distributed by the catalyst.

The importance of temperature on the catalyst selectivity as indicated by gasoline yield is presented in Fig. 7. The data were obtained in a fixed-bed pilot plant operating with a MoO_3-Al_2O_3 catalyst. All the results were first adjusted to a common hydrogen partial pressure—in this case 315 psi.—and to the same octane—90 C.F.R.R. At 1,050° F. the yield was 76 volume per cent; at 1,000° F., 80 per cent; at 950° F., 83 per cent, and at 900° F., 85.5 per cent. It is apparent that as the temperature was decreased the yield of gasoline of a given quality increased.

The fluid hydroforming pilot plant has been operated to obtain a liquid product containing hardly any material boiling above 400° F. by use of a feed stock with an end point somewhat below 400° F. Yields from a 39 C.F.R.M. octane 204/373° F. Mid-Continent heavy naphtha—where the liquid is substantially all 400-e.p. gasoline—are superior to those previously shown for a 425° F.-end-point feed stock.

TABLE 6—FLUID HYDROFORMING WITH MoO_3-Al_2O_3 CATALYST, 200°/344° F. WEST TEXAS NAPHTHA

Operating conditions:			
Pressure, psig	250	100	100
Temperature, °F	944	896	896
Yields on feed:			
Total liquid (10 lb. R.v.p.), vol. per cent	94.5	99.7	100.7
Gasoline inspections:			
Basis 10 lb. R.v.p. gasoline octane—C.F.R.R.	88.5	85.9	83.9
C.F.R.R + 3 cc. TEL	98.5	97.1	95.6

Fig. 8 illustrates graphically the relationship between 10-lb. R.v.p. gasoline yield and leaded research octane. At 500 psi. a yield of 83 volume per cent of 100 leaded research octane was obtained, while at 250 psi. this yield increased to 88 volume per cent of 100 leaded research octane gasoline.

In Table 6 summarized data are presented for experiments at 100 and 250 psi., operating on a West Texas naphtha. A molybdena-alumina gel catalyst was used. The feed stock had a boiling range of 200°-344° F. and a sulfur content of 0.23. Operating temperature ranged from 896° to 944° F. At 100 psi. and at 97 leaded research octane the 10-lb.-R.v.p. liquid yield was 99.7 volume per cent; at 95.6 leaded research the 10-lb. liquid yield was 100.7 volume per cent.

The importance of pressure is further illustrated by Fig. 9. When fluid hydroforming the 200°-344° F. West Texas naphtha the yield of 87 research octane gasoline (10-lb. R.v.p.) increased from 92.5 per cent at 500 psi. to 96 per cent at 250 psi. and to 98.5 per cent at 100 psi.

Fluid Hydroforming Cracked Naphtha

Table 7 shows results for simultaneous hydroforming and desulfurizing

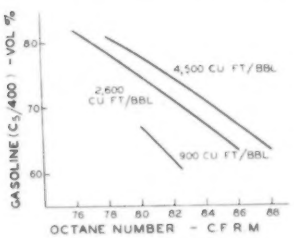

Fig. 5.

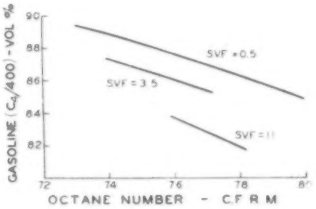

Fig. 6.

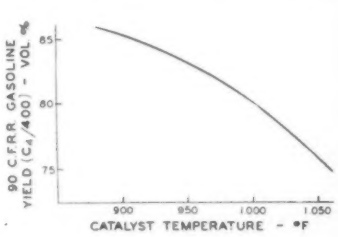

Fig. 7.

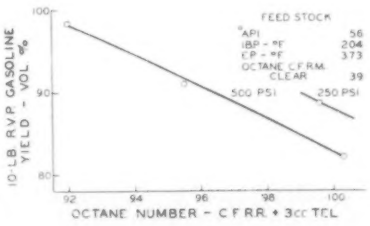

Fig. 8.

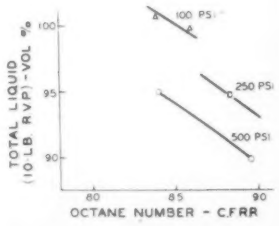

Fig. 9.

TABLE 7—FLUID HYDROFORMING HIGH SULFUR CALIFORNIA CRACKED NAPHTHA (142°/384° F.)

Catalyst—	MoO_3-Al_2O_3
Operating conditions:	
Temperature, °F.	938
Pressure, psig.	100
Product distribution:	
10 lb. R.v.p. liquid product, vol. %	97.0
Extraneous C_4 (for 10 lb. R.v.p.), vol. %	6.2
Dry gas, wt. %	5.8
Carbon, wt. %	1.8
Sulfur removed, wt. %	0.90
Gasoline inspections:	
R.v.p., psi.	10
Octane number:	
C.F.R.R.	84.4
C.F.R.R. + 3 cc. TEL	95.7
Sulfur, wt. %	0.01

TABLE 8—FLUID HYDROFORMING FOR AROMATICS OR 115/145 GRADE AVIATION GASOLINE 214°/291° F. VIRGIN NAPHTHA

Operating conditions:	
Pressure, psig.	250
Temperature, °F.	934
Yields on feed:	
100% C_5 liquid, vol. %	83.0
C_5 fraction, vol. %	6.9
Butenes	0.1
Isobutane	2.9
n-Butane	3.9
C_5 fraction, vol. %	7.2
Isopentane	3.8
n-Pentane	3.4
Depentanized liquid, vol. %	68.9
Preaviation blending agent, vol. %	22.8
Aviation blending agent, vol. %	33.5
Postaviation blending agent, vol. %	12.6
Carbon, wt. %	0.37
Hydrogen produced, cu. ft./bbl.	740

of high-sulfur California cracked naphtha. The boiling range of the feed stock was 142°-384° F. and the sulfur content of the feed was 0.91 weight per cent. The operating conditions were 938° F. and 100 psi. with a MoO_3-Al_2O_3 stabilized gel catalyst. The 10-lb.-R.v.p. liquid product yield was 97 volume per cent. This material contained 6.2 per cent extraneous butanes which were required to bring the Reid vapor pressure up to 10 lb. The clear research octane was 83.3 on the 100 per cent C_5 recovery gasoline and the leaded research octane 94.4. The leaded research octane of the 10-lb. R.v.p. gasoline was 95.7. The sulfur content of the gasoline was 0.01 weight per cent.

Fluid Hydroforming for Aviation Gasoline

Fluid catalyst process data shown in Table 8 have also been obtained for the production of high aromatics yields for aromatic blending components for 115/145 grade aviation gasoline. A 200°-300° F. (true boiling point) fraction from a mixed crude source was used as the feed stock. The test was conducted at a pressure of 250 psi. and a temperature of 934° F. The total liquid yield (C_5 and heavier) was 83 volume per cent. The isobutane yield was 2.9 volume per cent and the n-butane, 3.9 per cent. The isopentane yield was 3.8 volume per cent and the n-pentane yield, 3.4 per cent. The depentanized liquid product was fractionated into three cuts called preaviation, aviation, and postaviation blending agents. The yields of these three products were 22.8, 33.5, and 12.6 volume per cent, respectively. The carbon production was only 0.37 weight per cent basis feed. Hydrogen production was 740 cu. ft. per barrel. In Table 9 inspections for the various products of Table 8 are shown.

TABLE 9—FLUID HYDROFORMING FOR AROMATICS OR 115/145 GRADE AVIATION GASOLINE

Inspections of products:	
Debutanized liquid, octane number, C.F.R.R.	95.2
Preaviation blending agent, octane tane number, C.F.R.R. + 3 cc. TEL	91.8
Aviation blending agent:	
R.v.p., psi.	0.4
Blending octane number, F-3 + 4.6 cc. TEL	100
Blending index number, F-4 + 4.6 cc. TEL	216
Postaviation blending agent:	
R.v.p., psi.	0.5
Octane number, C.F.R.R.	>100

Fluid Hydroforming Economics

The economics of fluid hydroforming represent a considerable improvement over the fixed-bed process. This is attributed to reduced investment and operating costs in addition to the improved yield picture.

In Table 10 an economic balance sheet for a 7,500-bbl. per day fluid hydroformer is presented. The feed stock used in this estimate was a Mid-Continent heavy naphtha. It had an A.S.T.M. boiling range of 204°/373° F., and an octane number of 39 C.F.R.R. The motor gasoline had a 10-lb. R.v.p. and an octane rating of 95 C.F.R.R. + 3 cc. lead. The gasoline was assumed to be worth 12 cents per gallon and the feed stock 8 cents per gallon. Extraneous butanes were valued at 5¾ cents per gallon. Total credits were $36,325 per day and total debits (before depreciation), $30,092 per day. This left a credit less debit of $6,233 per day. The cost of the 7,500-bbl. per day plant was estimated at $2,250,000. Hence, a payout time of 1 year is indicated. In this calculation a gasoline yield representing 94-95 per cent of that observed in the laboratory was used. If the calculation had been based on the laboratory data the payout would be about 0.88 year.

TABLE 10—FLUID HYDROFORMING ECONOMICS 7,500 BPD UNIT

Credits—	Unit cost	BPD	$/Day
10 lb. R.v.p. gasoline	$5.04/bbl.	6,900	34,800
Fuel gas (FOE)	$1.90/bbl.	803	1,525
Total credits			36,325
Debits—			
Stock cost:			
Naphtha	$3.36/bbl.	7,500	25,200
Extraneous butanes	$2.42/bbl.	300	726
Direct operating cost:			
Total process costs			1,858
Ethylizing	0.2c/cc. TEL/gal.		1,713
Taxes, insurance, and royalties			585
Total debits (before depreciation)			30,092
Credits less debits			6,233
Investment, ($)		$2,250,000	
Payout time, years		0.99	

At the present time three fluid hydroformers are being constructed, one for Pan Am Southern Corp. at the Destrahan, La., refinery, a second for Cities Service at Lake Charles, and a third for Cities Service at East Chicago. It is expected that the Lake Charles fluid hydroformer will handle up to 30,000 bbl. per day of naphtha.

Acknowledgments

The author wishes to thank M. W. Kellogg Co. for permission to present the data included in this paper.

New Wire-Line Diamond Core Drill

(Continued from page 76)

line barrel cut a full 10-ft. core every time, and the operator realized an even greater saving in round trip time.

Other features.—Since a drill collar is used as the outer barrel of the wire-line core drill, the assembly is much stronger than the conventional thin-walled core barrel. The greater clearance between the outside of the outer core barrel and the side of the hole allows for better circulation and reduces the danger of sticking the barrel in the hole. Because of these two features, many operators consider that a safety joint is not necessary when running the wire-line diamond core barrel.

Another feature to be noted is the fact that most parts of the wire-line barrel illustrated on Fig. 1 are interchangeable with conventional barrels, so that the assembly may be easily converted to accommodate drag and roller core bits.

BOOKS

HOW TO CONVERT TO LP-GAS CARBURETION. By T. E. Wisby. Published by Ross-Martin Co., Tulsa. 448 pp. $10.

This book was developed because of the rapid trend toward the use of L.P.G. as an engine fuel. It has already been adopted as the text of the National LP-Gas Institute. It is generously illustrated with step-by-step graphs, diagrams, tables, and over 250 pictures. The author began gathering the material several years ago for classroom lectures, because no satisfactory complete manual was available. It covers the subject from a discussion of design and operation of internal-combustion engines, to the economics, sales, and general service problems involved.

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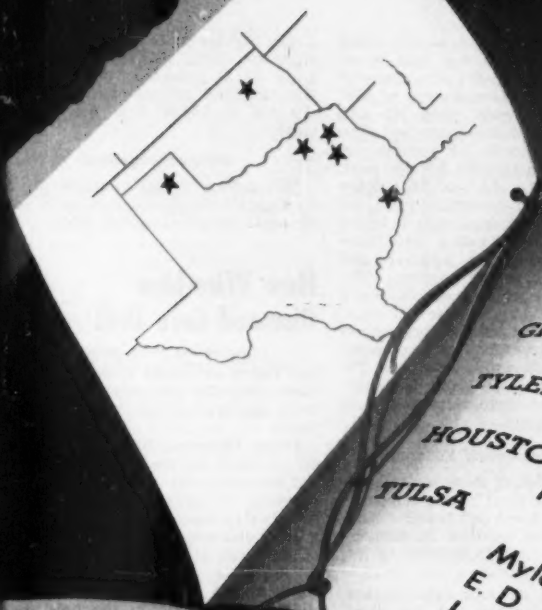

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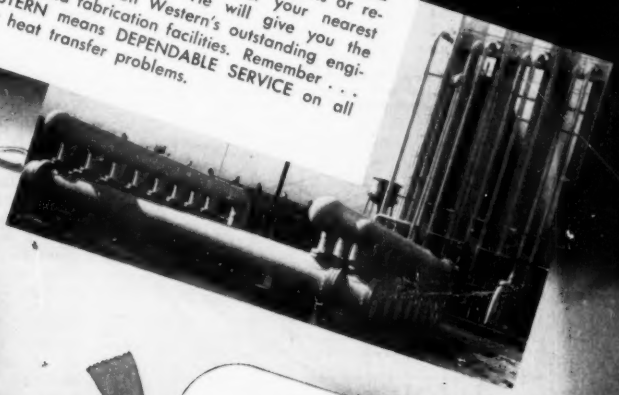

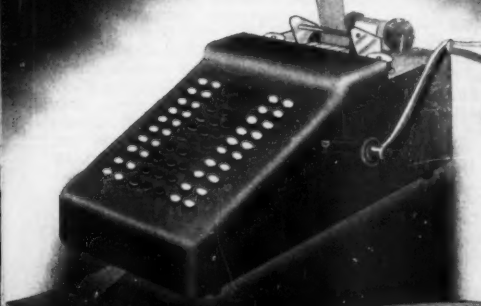

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QUESTIONS on TECHNOLOGY

by W. L. Nelson
Consulting Engineer

Recycle Stocks in Thermal Cracking

In analyzing cracking-plant operations, I am always needing the distillation curve of the furnace charge stock. Can you suggest references to us?—R. S. S.

Adequate information on recycle stocks and furnace charge stocks are not readily available. However, some information is presented here, and three references are listed. Four major elements govern the boiling range and shape of the furnace charge stock:

1. **Cracking temperature.**—The material exposed to the cracking reactions always consists of a mixture of hydrocarbons of different boiling range and refractoriness. The high-boiling ones decompose most rapidly, and this fact is exaggerated by high cracking temperatures. Thus, the distillation curves of furnace charge stocks, and particularly recycle stocks, tend to be flat or low boiling in the front portions and to rise rapidly after 80 or 90 per cent distilled. The higher the cracking temperature, the lower boiling or flatter are the distillation curves. This is illustrated in Fig. 1 and Table 1 by the vapor-phase stocks described by Curves 10, 11, and 12. High cracking temperatures produce low-characterization-factor recycle stocks.

2. **Recycle ratio and boiling range of charge stock.**—Recycle stocks usually have a lower boiling range than fresh charge stocks because of the relative ease of cracking high boiling portions as discussed under Item 1 above. If the charge stock has a high boiling range it tends to raise the boiling range of the furnace charge stock. This is somewhat illustrated by Curves 8 and 9. The curve of the pure recycle stock (No. 9) is flatter and lower boiling than the mixture of fresh feed and recycle stock shown in Curve 8. Recycle ratio tends to have the same general effect, but examination of Curves 4 and 5, and Curves 10, 11, and 12, indicate that large recycle ratios do not produce low-boiling recycle stocks or furnace feeds. Apparently the use of higher recycle ratios does not produce the low-boiling recycle stocks that would be expected at the higher temperature required by high recycle ratios. Curve 6 indicates the effect of a high-boiling reduced-crude feed stock, and Curve 13 a substantially pure recycle stock from a naphtha feed stock.

3. **End point of gasoline product.**—Obviously the end point of the gasoline or product lighter than the recycle stock, directly affects the front end of the distillation curve. The effect is somewhat as indicated in Fig. 1, although other factors such as fractionation, degree of stripping, and general boiling range of the rest of the distillation curve, also have some effect. Of course, pressure distillates that are to be subsequently treated and distilled usually have higher end points.

4. **Evaporator temperature, etc.**—The highest-boiling portion of recycle stocks and to some extent furnace charge stocks, is vitally affected by the temperature (and pressure) in the evaporator or coke chamber, or by the practice of vacuum or atmospheric flashing of the cracked fuel oil. Most cracking plants now operate at evaporator temperatures of 780°-820° F. and with flashing of the cracked residuum. This results in 95 per cent points for the furnace charge stocks of 775°-850° F. Without flashing, these 95 per cent points may range from 680° to 725° F. Coking may result in even higher 95 per cent points and when reforming, cracking primarily for gases or when cracking gases, the cycle stocks may have very low 95 per cent points.

The curves of Fig. 1 except Curves 6 and 7, were obtained by converting A.S.T.M. curves into true-boiling-point curves by the approximate method suggested on pages 405-406 of the third edition of Petroleum Refinery Engineering (McGraw-Hill Book Co., Inc., New York, 1949). Such conversions are subject to some doubt but they do permit a logical comparison whereas A.S.T.M. curves easily lead to erroneous conclusions.

TABLE 1—PROPERTIES OF THE FURNACE CHARGE STOCKS* OF FIG. 1

Curve	A.P.I.	Characterization factor	Recycle ratio	Aniline point (°F.)	Cracking temp. (°F.)	Source
1	24.7	11.05				Wagner[1]
2	24.7	11.2				Wagner[1]
3	25.6	11.2				Wagner[1]
4†	†20.0	†10.75	†2.4		920	3 plant tests, author
5†	†19.0	†10.6	†1.7		930	2 plant tests, author
6‡	‡20.8	‡10.85	‡2.0			Commercial vapor phase, author‡
7	24.8	10.9	3.0			Huntington & Brown[2]
8	24.5	11.2				Allen & Duckwall[3]
9*	*18.7	*10.72				Allen & Duckwall[3]
10	21.4	10.65	4.1	66	1,070	3 vapor-phase tests, author
11	21.8	10.7	3.3	67	1,097	5 vapor-phase tests, author
12	21.5	10.6	2.58	56	1,100	2 vapor-phase tests, author
13	30.6	11.05				Naphtha reforming

*Pure recycle stock rather than furnace charge. †745° F. evaporator temperature and pressure distillate end points of 440°-445° F. ‡Recycle (2) and Mid-Continent reduced crude (1), a black feed.

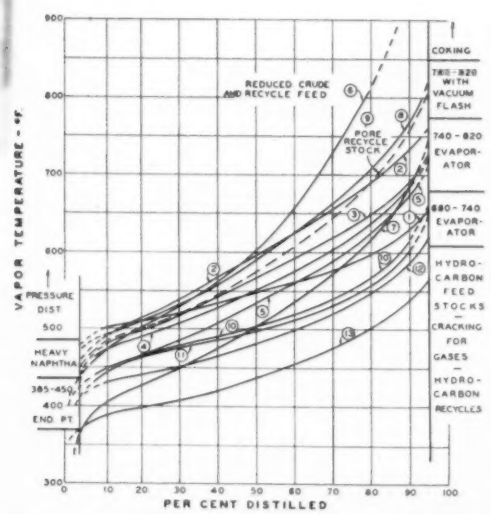
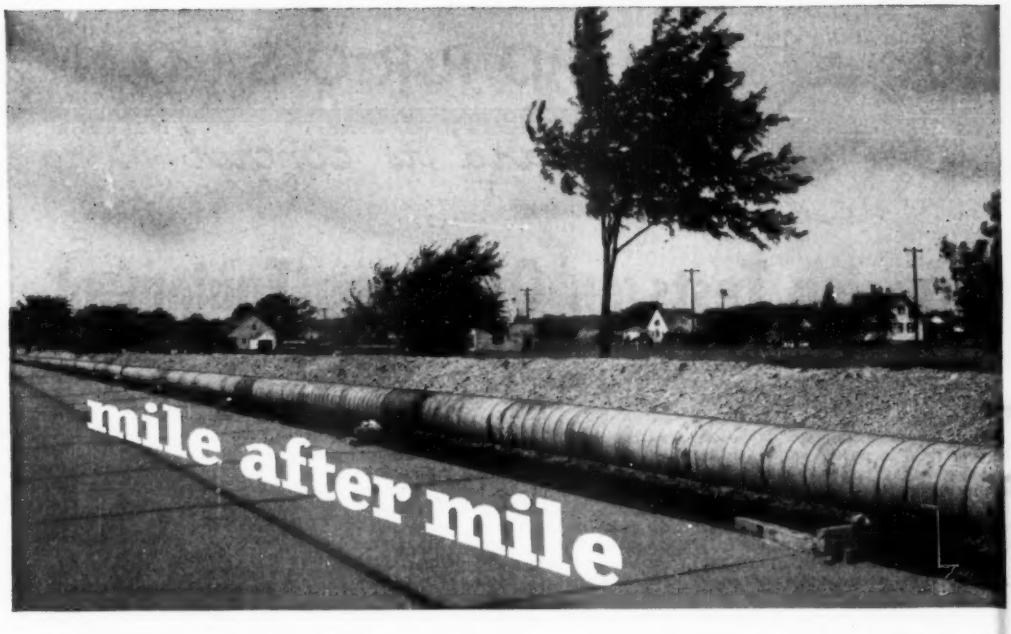


Fig. 1—True-boiling-point curves of furnace charge stocks in thermal cracking.

References

1. Wagner, C. R., Cracking Recycle Stock, The Oil and Gas Journal, Sept. 30, 1943, p. 45.
2. Huntington and Brown, Ind. Eng. Chem., 27, 699 (1935).
3. Allen and Duckwall, Pet. Refiner, Feb. 1945, p. 89.



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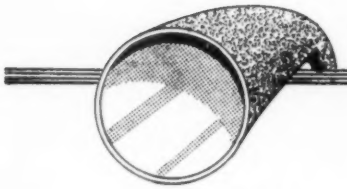


CORROSION and its control

Corrosion Tests on Operating Equipment

THE preceding three installments have dealt with the determination of corrosion rates by direct observation, by specimens inserted into vessels or piping, and by laboratory tests. It is also possible to infer the presence of active corrosion, and to some extent its rate, by the observation of auxiliary effects. These effects may be roughly classified as mechanical, chemical, and electrical.

Mechanical effects serve largely to indicate the presence of corrosion with little or no information as to its rate; often the information itself comes only after much damage has been done. The simplest example of a mechanical effect is a leak; that is, fluid appearing where it is not supposed to be, or missing from its proper location. Other effects which may be due to corrosion are: loss of pressure, indicating a possible hidden leak; increased resistance to fluid flow, which may indicate tuberculation or the clogging action of corrosion products; temperature changes due to mixing of fluids in heat exchangers; or visible contamination of a fluid by another or by corrosion products (e.g., "red water" in hot water systems).

Chemical Effects

Unlike mechanical effects, which are usually merely indicative, certain chemical effects are capable of quantitative interpretation. The last named, red water, may be considered a chemical effect. In the case of a hot-water system, it is obvious that the iron content of the water emerging from the system is acquired by solution of the metal from the piping or the tank. In many other systems, the presence of metal ions in the effluent can only mean corrosion in the equipment—and the amount of metal present correlates with the rate at which corrosion takes place. In actual practice, this technique is more valuable for the quick detection of changes in the rate of attack than for measurement of its absolute value. The results obtained from the use of inhibitors or other fluid treatment may be evaluated quickly and easily, without dismantling or even shutting down any equipment, by simply checking effluent fluid for its content of the proper metal ions.

Difficult Analysis

The possibility also exists of determining a corrosion rate by measuring the loss of an anion, such as chloride, or sulfate rather than by the gain in concentration of a metallic cation. Two difficulties attend this type of analysis: the anion whose concentration is decreased may be depositing as a scale, with no corrosion involved; even when corrosion is at the root of the problem, it is doubful if anything less than a disastrously high corrosion rate would produce a significant change in the concentration of an anion, unless the anion in question is in very small concentration and the process is highly selective. The method is promising, however, and the possibility of its application should not be overlooked.

Unexpected changes in the pH of effluent fluids obviously indicate some change in the chemical reactions taking place in the equipment; sometimes this change may be one involving corrosion, and the possibility must be considered; however, it must be conceded that such a reaction can never be more than indicative.

Quite the contrary is true of local changes in the pH of solutions at or very near the boundary of surfaces subject to corrosion; an almost invariable concomitant of active corrosion is a marked local change in pH. Characteristically, pH is lowered at corroding areas and raised at surfaces which are cathodically protected.

The study of electrical phenomena auxiliary to the process of corrosion has long been the classic approach of those dealing with soil corrosion; it is quite applicable to many other forms. Wherever the corrosion is electrolytic in nature, there are currents flowing in the corroding medium and in the corroded structure. These currents may sometimes be measured directly, but are more often studied by means of the potentials which they occasion.

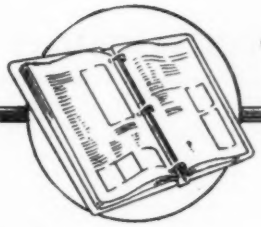
Current in the electrolyte may be measured by the use of two similar electrodes placed a short distance apart. Unless some rather difficult computations are made, this will not give the true current values, but if the spacing is held constant, variations in the potential difference at different points will be proportional to the variations in the current; or, with fixed positions of the electrodes, variations of potential with time will be proportional to the fluctuations in the current flowing.

Measuring Galvanic Effects

Current flowing in the metallic structure may be measured in a similar manner, by determining the potential difference between two points on the structure. Galvanic effects between two separate metal parts may be measured much more accurately if it is possible to insulate the two from one another and measure the current directly. It should be noted that permanent insulation of such structures is by no means always a wise course, since the insulation may merely force the current to detour through a conductive fluid, with consequent severe corrosion of the anodic part.

One other electrical quantity is of major importance with respect to corrosion—the current density on metal surfaces. This quantity is not at all easy to measure directly; if the total current flowing to a known area can be determined, the average current density follows directly; but where there is active corrosion, there is usually a decidedly nonuniform distribution of current density. In structures where cathodic protection has been applied, or is being studied, it is often possible to attach thin plates at various points, insulated from the structure itself, and with lead wires brought out to accessible points. It is then possible to measure (with a zero resistance ammeter circuit) the current flowing to each plate, and hence to arrive at reasonably dependable values for the local current density. Every effort should be made to insure that the material of the plates is identical in composition with that of the structure itself, or the results will be misleading.

Part 40 of a series by Marshall E. Parker, consulting engineer, Houston.



THE REFINER'S notebook

No. 103

Turbine Governor Mechanisms

by J. A. Pellettere*

THERE are three basic parts to a governor: (1) a speed-operated primary device, (2) mechanical or hydraulic linkage between the primary device and the steam control valve (steam valve position transmitter), and (3) the steam-control valve with its power unit (the servomotor). The secondary device is some means of transferring the output of the primary device or primary device motion so as to effectively position the power-operated steam valve in accordance with the speed change.

Other parts are: hand speed changer; a pneumatic device for adapting the air impulse from a pneumatic controller; a low-oil-pressure tripout mechanism; and in some cases a standby oil pump to protect against low oil pressure. The standby oil pump, while primarily for lubricating service, also provides standby hydraulic power for operating the governor. The hydraulic designers also have made available a positive throttle-trip valve with single-seated, tight shutoff characteristics. It can be used as the hand throttle during startup and also to provide a positive shutoff in the event of overspeed. A mechanical overspeed trip is available for the simple, mechanical-type governors.

*Gulf Oil Corp. Portion of paper presented at 1951 I.S.A. meeting, Houston.

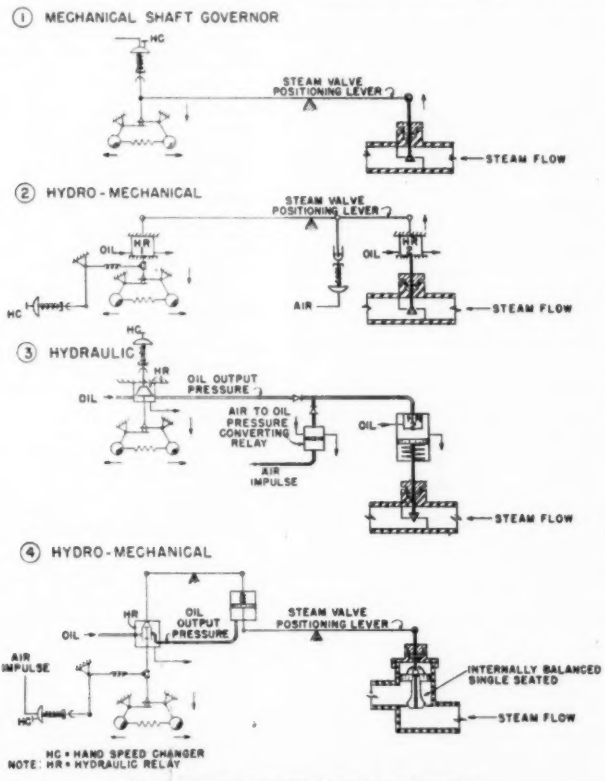


Fig. 1—Types of flyball governor mechanisms.

Types of governors.—Four typical manufacturers' types of flyball governors are shown in Fig. 1. These are: (1) mechanical, (2) hydromechanical, (3) hydraulic type wherein the flyball generates an output oil pressure, and (4) a hydromechanical wherein the flyball also produces a speed-modulated oil output pressure. The Type 1 so-called mechanical shaft governor is usually used in low-horsepower equipment and has about a 15 per cent change in speed range.

Hydraulic governors.—In Types 2 and 4 the flyball positions a lever which in turn operates the steam valve servomotor mechanism. Type 2 differs from Types 3 and 4, however, in that the flyball in Type 2 does not produce a speed-modulated oil pressure but does use a relay to position the transmitting lever. Type 4, like Type 3, has a flyball whose speed produces a proportionate oil discharge pressure. In Type 3 the hydraulic output pressure is allowed to pass through a pipe as a transmitter (secondary) to the servomotor.

Type 4 has a flyball which produces an oil discharge pressure from speed and uses a hydromechanical feedback system in such a manner that the flyball has a large range of operating speeds. A speed turn-down ratio of 4 to 1 is achieved easily by hand or by air-motor operation, in such a system as this. Note that in Type 2 and Type 3 the flyball is allowed to do no work by becoming a pre-emergency device when the pneumatic instrument is called upon to do the controlling. In the case of Type 3, this is rather unfortunate since this particular manufacturer's flyball does have a wide turn-down range and on the hand speed changer the flyball features are retained.

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Pipe-Line Construction

FOLLOWING is a tabulation of pipeline projects which are planned or under construction. Included are crude-oil, products, and natural-gas lines. This list is compiled from surveys made by The Oil and Gas Journal.

Crude-Oil Pipe Lines

Atlantic Pipe Line Co.—30 miles, 6-in., authorized, Brillhart Station to Ward County, Texas. Completion date 1-1-52.

Continental Pipe Line Co.—105 miles, 8-in., authorized, Rincon to northwest of Sullivan City on to Port Isabel, Tex. Completion date 1952.

Continental Pipe Line Co.—217 miles, 12-in., authorized, Wichita Falls, Tex., to Ponca City, Okla. Completion date 1952.

Derby Oil Co.—15 miles, 6-in., authorized Wichita to Bentley, Kans. Completion date 12-51.

Ohio Oil Co.—117 miles, 22-in., under way, Sheridan, Ind., to Lima, Ohio. R. A. Conyes, contractor.

Pan American Pipe Line Co.—27 miles, 26-in., Genoa to Texas City, Tex. Completion date 12-52.

Pan American Pipe Line Co.—40 miles, 14-in., Arden Station in Irion County to Eldorado Station in Schleicher County. 6-52.

Platte Pipe Line Co.—1,075 miles, 16-20-in., under way, Worland, Wyo., to Wood River, Ill. Completion date 1952.

Platte Pipe Line Co.—573 miles, 16-20-in., under way. Winchester, Wyo., to Brule, Neb. R. H. Fulton & Co. (Sections 1, 2, 3, and 4.—Section 1, 126 miles of 16-in., remainder 20-in.) A. A. Carrigan, spreadman at Casper, Wyo., field office.

Platte Pipe Line Co.—142 miles, 20-in., contracted, near Marysville, Kans., to Holdredge, Neb. Bishop & Lock (Section 5); H. LaQuey, spreadman.

Platte Pipe Line Co.—100 miles, 20-in., contracted, northern edge of Kansas. Rumsey Bros., contractor of Section 6.

Platte Pipe Line Co.—(Section 7). 274 miles, 20-in., Missouri River to Salisbury, Mo., and (Section 8) Salisbury to Mississippi River, under way, field office, Mexico, Mo.; B. C. Hall, spreadman; river crossing field office, Hartford, Ill., Dick Jernigan, spreadman.

Progress Pacific Pipe Line Co.—900 miles, 20-in., proposed, Permian basin, West Texas, to California.

Rancho Pipe Line System.—464 miles, 24-in., authorized, McCamey to Houston, Tex. Completion date late 1952. (Joint project with Sinclair Pipe Line Co., Pan American Pipe Line Co., Tidewater Pipe Line Co., Nantucket Pipe Line Co., and Phillips Pipe Line Co., with Shell Pipe Line Corp. handling construction and operation.).

Roosevelt Oil & Refining Corp.—22 miles, 4 and 6-in., authorized, St. Helens to Norwich, Mich.

Service Pipe Line Co.—19 miles, 16-in., under way, Raytown to Sugar Creek refinery, Mo. Sheehan Pipe Line Const. Co., contractor. J. W. Brown, spreadman at Raytown, Mo.

Service Pipe Line Co.—29 miles, 20-in., authorized; Drumright, Okla., to Humboldt, Kans.; 30 miles, 20-in., under way. Freeman to La Plata, Mo., G. G. Griffis Const. Co. Completion date 12-51. 24 miles, 10-in., contracted, Denton, N. M., to Wasson, Tex., Crossley and Hardy, contractor.

Shell Pipe Line Corp.—66 miles, 6-in., authorized, Gohlke to La Grange, Tex. Company crews. Completion date 1952.

Sinclair Pipe Line Co.—674 miles, 22-24-in., authorized; Drumright, Okla., to E. Chicago, Ind. Completion date 1952.

Sinclair Pipe Line Co.—150 miles, 24-in., contracted, Drumright-Cushing, Okla., area, to Humboldt, Kans. O. R. Burden Construction.

Skelly Oil Co.—38 miles, 8-in., under way, Lyons to Burrton, Kans. Rumsey Bros., contractor. Completion date 1-52.

Texas Pipe Line Co.—319 miles, 22, 12, 10-in., Louisiana Gulf Coast to Port Arthur, Tex., including 220 miles, 22-in., Houma, La., to Port Arthur, Tex.; 31 miles, 12¾-in., Houma to Cocodrie, La. Houston Contracting Corp. Completion date in summer 1952.

West Texas Gulf Pipe Line Co.—467 miles, 26-in., authorized, Colorado City to Wortham, Tex., 26-in.; Wortham to Sour Lake, Tex., 24-in. Completion date 10-52.

West Texas Gulf Pipe Line Co.—114 miles, 20-in., authorized, Wortham to Longview, Tex. Completion date 10-52.

Products Pipe Lines

Bell Oil & Gas Co.—150 miles, 6-in., planned, Ardmore to Drumright, Okla. (Includes 114 miles, 8-in.; 32 miles, 6-in.)

Buckeye Pipe Line Co.—370 miles, 8, 12, 16-in., authorized, Linden, N. J., via Allentown, Pa., to Auburn, Syracuse, Waterloo, and Rochester, N. Y. (Sections divided as follows: 75 miles, 16-in., 218 miles, 12-in., 77 miles, 8-in.) Start 1952, completion of 16-in., 1952, balance 1953.

Ohio Oil Co.—24 miles, 8-in., authorized, East St. Louis to Wood River, Ill.

Phillips Oil Co.—28 miles, 12-in., authorized, Sweeny to Freeport, Tex.

Phillips Pipe Line Co.—68 miles, 12¾-in., under way, Osawatomie westward to Wichita, Kans. Brown Lite Co. R. E. Carriker, spreadman at Osawatomie, Kans.

Phillips Pipe Line Co.—40 miles, 10-in., through Monteau, Cole, Osage, and Gasconade counties, Missouri. Trojan Const. Co. E. L. Maggard, spreadman at Linn, Mo.

Phillips Pipe Line Co.—48 miles, 12-in., under way, looping from Wichita, Kans., to Buffalo, Okla. G. G. Griffis Const. Co. Joe Bishop, spreadman, at Medicine Lodge, Kans. 12-51 completion date.

Phillips Pipe Line Co.—74 miles, 8-in., under way, looping from Decatur, Ill., to East Chicago, Ind. Somerville Const. Co., contractor. 12-51 completion date.

Phillips Pipe Line Co.—69 miles, 12-in., authorized, looping from Paola to Wichita, Kans.

Phillips Pipe Line Co.—137 miles, 10-in., authorized, looping from Paola, Kans., to East St. Louis, Ill. Completion date 11-51.

Progress Pacific Pipe Line Co.—900 miles, 10-in., proposed, California to West Texas.

Salt Lake Pipe Line Co.—Proposed, Pasco, Wash., to Puget Sound.

Shell Oil Co.—565 miles, 8-14-in., planned, Wood River via East Chicago to Detroit; 35 miles, 14-in. Completion date summer of 1952.

Sinclair Pipe Line Co.—8-in., proposed, Sinclair, Wyo., to Salt Lake City, Utah; 10-in., Houston to Baton Rouge; 16-in., Kalamazoo to Detroit; 20-in. Marcus Hook to aByonne, N. J.; East Chicago to South Bend, Ind.

Socony-Vacuum Oil Co., Inc.—175 miles, 6-8-in., under way, Augusta, Kans., to Kansas City, Mo. Ray L. Smith & Son, Inc. (Spreadmen are located as follows: Dewey Whitworth at Topeka, Kans.; Carl Samuel Colvin at Burlingame, Kans.; George Kelpar at Topeka, Kans.; Clark Liggett, Tonganoxie, Kans.) Completion date 1-1-52.

Standard Oil Co. (Ind.).—122 miles, 8-in., under way, Neodesha, Kans., to Belton, Mo. Bills & Troth Construction Co., Carl Bills, superintendent, at Armory Building, Neodesha. Completion date 1952.

Standard Oil Co. (Ohio).—17 miles, 6-in., authorized, Toledo to West Toledo, Ohio.

United States Pipe Line Co.—1,000 miles, proposed, Gulf Coast via Memphis, Nashville, Tenn., Lexington, and Paducah, Ky., to Cincinnati, Ohio.

Natural-Gas Pipe Lines

Allied Gas Co.—24 miles, 6⅝-in., proposed. McLean to Champaign County, Illinois.

Amere Gas Utilities Co.—16 miles, 8⅝-in., proposed, loops from Mercer County to Princeton, W. Va.

Amere Gas Utilities Co.—15 miles, 8⅝-in., proposed, near Dameron to Flat Top, W. Va.

Associated Natural Gas Co.—88 miles, authorized, Missouri.

Carolina Natural Gas Corp.—185 miles, 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

Cities Service Gas Co.—179 miles, 4-30-in., gathering system in vicinity of Ulysses, Kans. Vaughn & Taylor Const. Co., Inc. D. D. Vaughn, spreadman, Ulysses.

Coast Counties Gas & Electric Co.—40 miles, 3, 4, and 8-in., planned. Coast and Valley region, California.

Colorado Interstate Gas Co.—250 miles, 30-in., under way, Kit Carson, Colo., to Amarillo, Tex. R. H. Fulton & Co., contractor. Jerry Nash, spreadman at Lamar, Colo.

Commonwealth Natural Gas Corp.—537 miles, 20-in., proposed, West Bend, Ky., to Norfolk, Va.

Cumberland and Allegheny Gas Co.—46 miles, 10-in., authorized, Mountain Lake Park, Md., to Preston County, W. Va.

Dow Chemical Co.—70 miles, various sizes, Midland, Saginaw, and Bay City, Mich.; Mahoney Contracting Co., contractor, Ralph Bucher, spreadman at Midland.

East Tennessee Natural Gas Co.—172 miles, 22-in., authorized, Greenbrier to Oak Ridge, Tenn.

East Tennessee Natural Gas Co.—100 miles, 16-in., proposed, Knoxville to Kingsport, Tenn.

El Paso Natural Gas Co.—122.9 miles, 30-in., proposed, looping along main line in Texas, New Mexico, Arizona.

Equitable Gas Co.—17 miles, 16-in., under way, near Pittsburgh. H. L. Gentry Const. Co., contractor. Lavern Curtis, spreadman at Sewickley, Pa.

Georgia Gas Co.—32 miles, 4½-in., proposed, Bogart to Gainesville, Ga.

Glacier Gas Co.—285 miles, 20-in., proposed, Kalispell, Mont., to Spokane, Wash.

Glacier Gas Co.—120 miles, 16-in., proposed, Spokane to Hanford, Wash.

Glacier Gas Co.—91 miles, 8⅝-in., proposed, Spokane to Lewiston, Idaho.

Glacier Gas Co.—130 miles, 12¾-in., proposed, Spokane to International boundary at Trail, British Columbia.

Grand Valley Pipe Line Co.—105 miles, 8-10-in., planned, Piceance Creek field to Rifle on to Grand Junction, Colo.

Gulf Michigan Transmission Corp.—680 miles, 30-in., proposed, Perryville, La., across Arkansas, Missouri, and Illinois to terminus near St. John, Ind.

Home Gas Co.—17 miles, 12-in., proposed, loops from Hancock to Sanford, N. Y.

Houston Pipe Line Co.—24 miles, 18-in., under way, Houston to Bammel gas field, Harris County, Texas.

Iowa-Illinois Gas & Electric Co.—41 miles, 10-in., authorized, Washington County to Cedar Rapids, Iowa.

Kansas-Nebraska Natural Gas Co.—40 miles, 6-in., under way. Albion to Norfolk, Neb. Jayhawk Const. Co., Inc., contractor; F. A. Faler, spreadman at Albion.

Kansas-Nebraska Natural Gas Co.—30 miles, 6-in., under way, Albion to Neligh, Neb. Jayhawk Const. Co., Inc., F. A. Faler, spreadman at Albion.

Kansas-Nebraska Natural Gas Co., Inc.—60 miles, 8-10-12-in., under way, Grand Island to Albion, Neb.

Kansas-Nebraska Natural Gas Co.—65 miles, 2-8-in., authorized, Big Springs field to Ogallala, Neb., and to Ovid, Colo.

Kansas-Nebraska Natural Gas Co., Inc.—39 miles, 4 and 6-in., planned, Neligh to O'Neill, Neb., 54 miles, 4 and 6-in. planned, Neligh to Hartington, Neb. (extension) Completion date 1952.

Kansas Power & Light Co.—27 miles, 20-in., authorized. Pratt, Kans., to Calista compressor station.

Lake Shore Pipe Line Co.—45 miles, 10¾-in., authorized, northwesterly from T.G.T. system near Meadville, Pa., to Ashtabula, Ohio

Michigan Gas Storage Co.—93 miles, 16-22-24-in., under way, Laingsburg to near Pontiac and Mount Clemens, Mich. (Includes 17 miles of lateral lines.) Mahoney Contractor. Completion date 6-52.

Michigan Gas Storage Co.—30 miles, 26-in., authorized, looping between Laingsburg and Mount Pleasant Junction, Mich.

Michigan Gas Utilities Co.—77 miles, under way, Sturgis, Hillsdale, and Coldwater, Mich. (22.7 miles, Marshall south to Coldwater; 20 miles, Coldwater easterly to Hillsdale; 22.5 miles, Hillsdale to Sturgis; 11 miles, Hillsdale to Jonesville.) Somerville Const., contractor. Jim Godwin at Coldwater.

MidSouth Gas Co.—240 miles, proposed. Greene, Poinsett, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, and Cross counties, Arkansas.

Mississippi River Fuel Corp.—98 miles, 16- and 18-in., authorized, feeder line from Lincoln Parish, Louisiana, to Waskom field, Harrison County, Texas.

Mississippi River Fuel Corp.—40 miles, 18-in., authorized, Dubach to Perryville, La.

Montana Power Co.—52 miles, 16-in., authorized, Canada-Montana border to Cut Bank, Mont.

National Utilities Co. of Michigan.—76.7 miles, 20-in., proposed, South Central Michigan. (22 miles from near Marshall south to Coldwater; 20 miles east to Hillsdale; 22 miles southwest to Sturgis; 5 miles from Hillsdale to Jonesville and 6 miles west to Union City.)

New River Gas Co.—50 miles, planned, Summers or Monroe counties, West Virginia to Narrows and Dublin, W. Va.

New York State Natural Gas Corp.—66 miles, 20-in., proposed, looping on Westmoreland, Armstrong, and Tioga counties, Pennsylvania. (Includes 17 miles, 16-in. in Potter County, Pennsylvania, and 21 miles 14 in., replacement in Line No. 507, New York.)

Niagara Mohawk Power Corp.—40 miles, 10-12-16-in., under way, lateral lines at Utica, N. Y.; 55 miles, 10-in., Fulton to Watertown, N. Y.; Williams-Austin Co., contractor, Howard Bauer, supt.

Northeastern Gas Transmission Co.—511 miles, 20-24-in., authorized, New Hampshire, Massachusetts, and Connecticut.

Northeastern Gas Co.—411 miles, proposed, New England towns.

Northern Natural Gas Co.—580 miles, proposed, Kansas, Texas, Oklahoma, and Nebraska loops.

Northern Natural Gas Co.—370 miles, 4-26-in., authorized, gathering lines in Hugoton field.

Northern Natural Gas Co.—217 miles, 26-in., under way, Palmyra, Neb., to Skellyville, Tex. G. G. Griffis Const. Co., contractor; field office, Beatrice, Neb.; G. L. Mims, superintendent; E. G. Grisham, spreadman.

Northern Natural Gas Co.—210 miles, 26-in., proposed, five loops in Texas-Oklahoma area, two in Kansas, and two in Nebraska.

Northern Natural Gas Co.—181 miles, 4-12-in., contracted, gathering system in Hugoton area. Reese Bros. Const., contractor. Completion date in spring.

Northern Natural Gas Co.—108 miles, 26-in., under way, Beatrice, Neb., to Mullenville, Kans. G. G. Griffis Const. Co. E. G. Grisham, spreadman at Great Bend, Kans. Completion date 12-1-51.

Northern Indiana Fuel & Light Co.—33 in., authorized, Perryville Station, La., to Boeuf River.

Northwest Natural Gas Co.—750 miles, planned, Washington, Oregon, and Idaho.

Ohio Fuel Gas Co.—25 miles, 20-in., under way, Xenia, Ohio. Sheehan Pipe Line Const. Co. Earl Williams, spreadman at Xenia.

Ohio Fuel Gas Co.—22 miles, 16-in., authorized, Dayton, Troy, Piqua, and Sidney, Ohio.

Ohio Fuel Gas Co.—23 miles, 16-20-in., authorized, Wellington to Elyria, Ohio; 16 miles, 20-in. authorized, Benton Station to Crawford Station, completion date 11-15-51. 18 miles, 20-in., Crawford Station to near Columbus, completion date 12-31-51. 16 miles, 16-in., authorized, Berlin Heights to Sandusky, Ohio, completion date 12-31-51.

Ohio Fuel Gas Co.—74 miles, 3 to 20-in.,

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authorized, Hocking, Knox, and Ashland counties, Ohio.

Ohio Fuel Gas Co.—47 miles, 20-in., authorized, Benton Township, Hocking County, to Columbus, Ohio.

Ohio Fuel Gas Co.—61 miles, authorized northern and southwestern Ohio.

Oklahoma Natural Gas Co.—14 miles, 8⅝-in., under way, Shamrock to Cushing, Okla.; 21 miles, 24-in., under way, Depew to Kellyville, Okla. Completion date 1-15-52. 9 miles, 12¾-in., Stroud to Depew, Okla. 26 miles, 12-in., under way, Ringwood to Enid, Okla. Completion date 3-15-52.

Pacific Gas & Electric Co.—44 miles, 8-in., under way, Salinas to King City, Calif.

Pacific Gas & Electric Co.—141 miles, 34-in., proposed, parallel sections along Topock-Milpitas line.

Pacific Gas & Electric Co.—10 miles, 10-12-in., authorized, Monterey to Fort Ord to Castroville; 12 miles, 16-in., Napa Wye to Shellville; 6 miles, 12-in., Cotati to Santa Rosa, Calif.

Pacific Northwest Pipe Line Co.—400 miles, 22-in., gathering lines on Texas Gulf Coast to Pacific Northwest pipe line.

Pacific Northwest Gas Pipe Line Corp.—1,175 miles, planned, Wharton County, Texas, via Oklahoma, Kansas, Fort Collins, Colo., to Portland, Ore., Tacoma and Seattle, Wash.

Panhandle Eastern Pipe Line Co.—70 miles, 24-26-in., under way, looping from Sneed, Tex., to Emporia, Kans.

Panhandle Eastern Pipe Line Co.—174 miles, 30 and 26-in., contracted, Tuscola, Ill., eastward—looping present system; R. A. Conyes, contractor. 44 miles, 26-in., Edgerton, Mich.; Anderson Bros.; 22 miles, 30-in., looping in Tuscola, Ill.; 45 miles, 30-in., looping in Montezuma, Ind.; 63 miles, 30-in., looping in Zionsville, Ind.

Pennsylvania Gas Co.—52 miles, 12-in., between Warren and Erie, Pa. (Section 1—27 miles, under way and contracted by Harford Bros. Section 2—25 miles.

Peoples Natural Gas Co.—25 miles, proposed, Cambria and Blair counties, Pennsylvania.

Phillips Petroleum Co.—118 miles, 3-22-in., under way, Sherman and Hansford counties, Texas, gas-gathering system; Vaughn & Taylor Construction Co., Inc., Dumas, Tex., J. F. Crawford, spreadman at Texhoma, Okla.

Piedmont Natural Gas Co.—28 miles, 6-in., proposed, North Carolina, laterals from Transcontinental gas system.

Prince George's Gas Corp.—20 miles, 22-in., authorized, between Chillum and Rockville, Md.

Public Service Co. of North Carolina.—33 miles, 10-in., authorized, Burlington to Chapel Hill, N. C., completion date 3-1-52; 16 miles, 8-in., authorized, Chapel Hill to Raleigh, N. C., completion date 7-1-52; 29 miles, 4-in., authorized, Statesville to Kanapolis, N. C., completion date 7-1-52; 83 miles, 8-in., authorized, Kings Mountain to Asheville, N. C., completion date 3-1-53.

Rockland Light & Power Co.—22 miles, 8-in., proposed, Orangetown to Tompkins Cove, N. Y.

Southern California Gas Co.—35 miles, planned, Antelope Valley, California.

Southern California Gas Co. and Southern Counties Gas Co. of Calif.—45 miles, 30-in., proposed, looping on line from Arizona border to Los Angeles.

Southern California Gas Co. and Southern Counties Gas Co.—36 miles, 6-8-in., contracted, Palmdale to Mojave, Calif., Alex Robertson Co., contractor, E. C. Neal, spreadman at Lancaster, Calif., completion date 11-1-51.

Southern California Gas Co. and Southern Counties Gas Co. of California.—81 miles, 30-in., proposed, Whitewater to Desert Center, Calif.

Southern Natural Gas Co.—21 miles, 24-miles, 8-in., proposed, Edgerton to Auburn, Ind.

Southern Natural Gas Co.—14 miles, 24-in., authorized, Onward Station, Miss., to Big Sunflower River.

Southern Natural Gas Co.—14 miles, 14-in., authorized, Perryville Station, La., to Wilhite Gate.

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Southern Natural Gas Co.—375 miles, 24-in., planned, Gwinville, Miss., to Atlanta, Ga.

Southern Natural Gas Co.—169 miles, proposed loops, Ouachita Parish, Louisiana, to Augusta, Ga.; 26 miles in Ouachita Parish, 33 miles in Ouachita and West Carroll parishes; 7 miles, Sharkey County, Mississippi; and 108 miles, 14-in., Bass Junction to Augusta, Ga.

Southwest Gas Corp., Ltd.—26 miles, proposed, from P.G.&E. line to Victorville, Calif.

Sunray Oil Corp.—133 miles, 3-30-in., under way, system for Snyder gasoline plant. Vaughn & Taylor Construction Co., contractor. D. D. Vaughn, spreadman.

Tennessee Gas Transmission Co.—521 miles, planned, looping along present system; 420 miles, 30-in., Texas, La., Ark., Miss., Tenn., and Ky.; 101 miles, 26-in., in Kentucky and Ohio.

The Texas Co.—27 miles, 8-in., authorized, Ventura to Filmore, Calif.

Texas Eastern Transmission Corp.—791 miles, 30-in., under way, Kosciusko, Miss., to Connellsville, Pa.

(Section 1 and 2) 163 miles, 30-in., under way, Kosciusko, Miss., to Florence, Ala. Williams Bros.-Davis Co.

(Section 3) 76 miles, 30-in., Florence, Ala., to Columbia, Tenn. Eastern Pipe Line Contractors.

(Section 4) 73 miles, 30-in., under way, Columbia, Tenn., to Cumberland River. H. B. Zachry Co. A. Vaughn superintendent at Lebanon, Tenn. Completion date 12-10-51.

(Section 5) 79 miles, 30-in., under way, Cumberland River to Columbia, Ky. Oman Const. Co. William Smith, superintendent and Floyd Hudnell, spreadman at Columbia, Ky.

(Section 6) 82 miles, 30-in., under way, Columbia, Ky., to Boonesboro, Ky. N. A. Saigh Co.

(Section 7) 100 miles, 30-in., under way, Kentucky River to Ohio River, northeastern Kentucky. Mahoney Const. Co.

(Section 8) 77 miles, 30-in., under way, Portsmouth to Amesville, Ohio. Anderson Bros. Corp.

(Section 9) 74 miles, 30-in., under way, Amesville to Ohio-West Virginia river crossing. Anderson Bros. Corp.

(Section 10) 66 miles, 30-in., under way, Ohio River to Connellsville, Pa. Anderson Bros. Corp.

Texas Eastern Transmission Corp.—50 miles, 30-in., under way, Ohio River to Vanceburg, Ky. Trojan Construction Co., Inc., contractor. Charles Tillotson, spreadman at Morehead, Ky.

Texas Gas Transmission Corp.—35 miles, 12-in., authorized, Slaughters, Ky., to Evansville, Ind.

Texas Gas Transmission Corp.—189 miles, 26-in., authorized, Acadia Parish to connection with existing facilities in Morehouse Parish.

Texas Gas Transmission Corp.—195 miles, 26-in., proposed, Gulf Coast region to southwestern Louisiana.

Texas Gas Transmission Corp.—425 miles, 26-in., authorized, looping from Bastrop, La., to Hardinsburg, Ky.

Texas Gas Transmission Corp.—181 miles, 26-in., under way, Bastrop to Eunice, La. Houston Contracting Co. (North spread near Beekman, 65 miles south to Grayson, La., W. H. Hayes, supt.; center spread, north side of Red River at Pineville, 60 miles north to Grayson, E. C. Norris, supt.; south spread, south side of Red River, 56 miles south to Tepetate field near Eunice, F. A. Silar, supt.)

Texas Gas Transmission Corp.—580 miles, 26-in., proposed, Louisiana and Kentucky.

Texas-Ohio Gas Co.—1,350 miles, 30-in., authorized, Hidalgo County, Texas, through Arkansas, Mississippi, Tennessee, and Kentucky on to Spencer, W. Va. Completion date 6-30-53.

Union Gas & Electric Co.—33 miles, 8-in., Farmer City to Bloomington, Ill. Contracting & Material Co. A. T. Perry, spreadman at LeRoy, Ill. Completion date 12-15-51.

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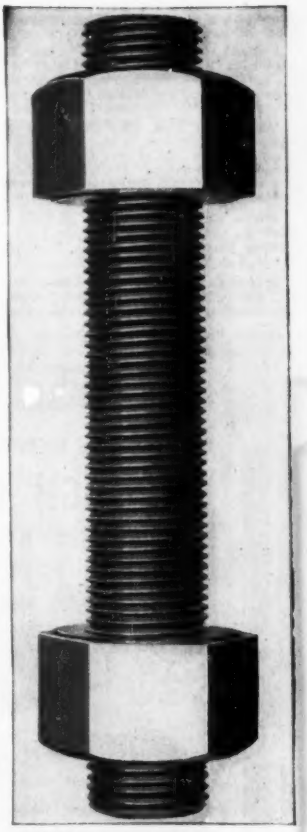

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Union Oil Co. of California.—40 miles, 8-10-in., planned, San Joaquin Valley and Los Angeles Basin.

United Fuel Gas Co.—32 miles, 20-in., under way, Lanham to Broad Run, W. Va. H. L. Gentry Construction Co., contractor. Frank Morris, spreadman at Charleston, W. Va.

United Gas Pipe Line Corp.—315 miles, 24-30-in., contracted, Agua Dulce to near Goodrich, Tex. Oklahoma Contracting Co., contractor. Panama Shiflett, spreadman, El Campo, Tex.; Ray Law, spreadman, Victoria, Tex.

United Gas Pipe Line Co.—93 miles, 20-24-26-in., under way, Houston to Du Pont's Sabine River Works, Orange, Tex. River Const. Co.

United Gas Pipe Line Co.—50 miles, 16-in., authorized, Baldwin County, Alabama, southeasterly to Escambia County, Florida.

United Gas Pipe Line Co.—100 miles, 20-24-26-in., contracted, near Houma to Franklin, La.; Associated Pipe Line Contractors, Inc.

United Gas Pipe Line Corp.—510 miles, 24-26-30-in., contracted, Agua Dulce, Tex., to Monroe, La.; 233 miles, 20-24-26-30-in. from Pure Oil Co.'s offshore platform, Block 32 Eugene Island area to Jackson, Miss., comp. sta.; 60 miles, 12-16-20-in., from Lafayette comp. sta. and Weeks Island field to Franklin, La., to connect with above mentioned 30-in.; 59 miles, 30-in., Jackson comp. sta., Miss. to Texas Eastern Trans. Corp.; 124 miles, Sterlington comp. sta. near Monroe, La., to Jackson comp. sta., Miss.; 23 miles, 8-12-16-in., South Louisiana facilities; all contracted by Gulf Southern Contractors, a joint venture including Texas Louisiana Contractors; Oklahoma Contracting Co.; J. Ray McDermott and Morrison Knudson. Inspection by Brown & Root, Inc.

United Gas Pipe Line Co.—65 miles, 30-in., under way, Gonzales, La., to Kosciusko, Miss. River Const. Corp. Red Tatum, spreadman at Hammond, La. Completion date 11-51.

United Gas Pipe Line Co.—43 miles, 24-in., under way, Baxterville, La., to McComb, Miss. River Const. Corp. Jim Reed, spreadman at Columbia, Miss. Completion date 11-1-51.

United Gas Pipe Line Co.—87 miles, 20-in., under way, State Line to Jackson, Miss. River Const. Corp. Merle Tatum, spreadman at McComb, Miss. Completion date 12-15-51.

U.S.E.D.—13 miles, 8⅝-in., contracted, Norwalk to Long Beach, Calif. J. E. Young Pipeline Contractor, Inc.

Utah Natural Gas Co.—360 miles, 22-in., proposed, San Juan Basin area to Salt Lake, Utah.

Virginia Natural Gas Co.—153 miles, Buckingham to Richmond and Portsmouth, Va.

Western Kentucky Gas Co.—2 to 4-in., under way, additions to present system; Modern Welding Co., Inc., contractor.

Western Pipe Lines.—1,200 miles, 22-in., planned, southern Alberta to Duluth, Minn.

West Texas Gas Co.—27 miles, 10-in., authorized, Lubbock to Abernathy, Tex.

West Texas Gas Co.—32 miles, proposed, Potter and Randal counties, Texas.

Foreign Crude-Oil Pipe Lines—Planned and Under Way

Alberta-Vancouver Oil Pipe Line Co.—(Brokaw, Dixon, McKee).—972 miles, 16-in., proposed, Edmonton via Pincher Creek, Alta., Idaho and Washington states to Vancouver, B. C.

Cia. de Petroleo Ganso Azul, Ltd.—48 miles, 4-in., planned, Ganso Azul field to Pucalpa on upper Ucayali River, Peru.

Condor S.P.A.—82 miles, 12-in., under way, Genoa to Rho, near Milan, Italy.

Direccion General de Yacimientos Petroliferos Fiscales.—409 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Independent Pipe Line Co.—721 miles, 16-18-22-in., proposed, Edmonton to Vancouver. Spreads as follows: 185 miles of 22-in.; 391 miles, 20-in.; 95 miles, 16-in.; and 30 miles, 18-in.

Iraq Government.—135 miles, 12-in., proposed, from Iraq Petroleum Co. at Baiji to Baghdad, Iraq. Construction 1952. M. W. Kellogg, contractor.

Iraq Petroleum Co., Ltd.—556 miles, 30-32-in., under way, Kirkuk, Iraq, to Banias, Syria, 1952; Bechtel-Kirkuk, contractor.

Iraq Petroleum Co., Ltd.—72 miles, 12¾-in., Zubair to Fao. Arabian Bechtel Co., contractor. Completion date 12-51.

Middle East Pipelines, Ltd.—800 miles, 34-35-in., planned, Iran to a Levantine port.

Petroleos Mexicanos.—145 miles, 12-in., considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

Petroleos Mexicanos.—100 miles, planned, Isthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

Shell Caribbean Petroleum Co.—160 miles, 30-in., under way; Palmajero to terminals on the Paraguana Peninsula (Cardon and Las Piedras, Venezuela), 4-52. Land sections contracted by Williams Brothers, de Venezuela, S.A., Charles P. Williams, manager, Marvin E. Jones, superintendent. Water crossings contracted by Mahoney Contracting Co.

Texas Petroleum Co.—60 miles, 4-6-in., under way, Pto. Nino to La Dorada.

Trans-Mountain Oil Pipe Line Co.—715 miles, proposed, Edmonton, Alta., to Vancouver, B. C. Canadian Bechtel, Ltd., engineers.

Foreign Products Pipe Lines—Planned and Under Way

Colombia Ministry of Petroleum.—90 miles 6-in., planned, Puerto Berrio to La Dorada, Colombia.

Colombia Ministry of Petroleum.—113 miles, 6-in., contracted, Puerto Berrio to Acedeo near Medellin, Colombia. Carolina Construction Co.

Colombian Ministry of Petroleum.—75 miles, 4-in., planned, Buena Ventura to Cali, Colombia.

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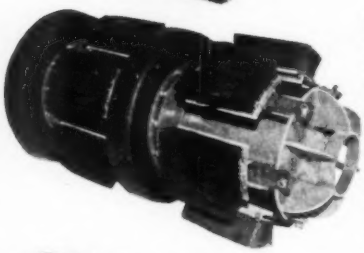
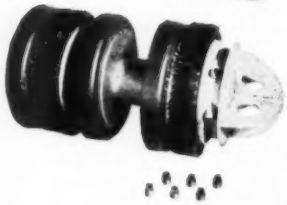


Type GP-4 Pig 16" to 30" sizes. Similar design for 10" to 14" sizes. Brushes expanded by arched springs. Brush & cup service life up to 1,000 miles.



Type RC-50 Pig 8" to 14" sizes. 6" size, similar, type SC-50. Jet-rotation feature distributes wear of brushes and cups.

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50 miles, 4-in., contracted, Guayaquil to Palmira, Ecuador. J. A. Jones, contractor; C.R.C. Engineering Co., engineers.

Estrada de Ferro Santos a Jundiai.—92 miles, 18-in., under way, Santos to Sao Paulo, Brazil (fuel oil line); Techint, contractor. Completion date 12-51.

Governments of Southern Rhodesia and Portuguese East Africa.—200 miles, considered, Beria, Portuguese Mozambique to Umtali, Southern Rhodesia.

Imperial Oil Co., Ltd.—230 miles, 10-12-in., under way, Sarnia via London, Hamilton to Toronto, Ont., Canada. Comstock Midwestern, Ltd., contractor. Completion date July 1952.

Petrocongo (Sub. Cie. Financiere Belge des Petroles, S.A.).—225 miles, considered, Ango-Ango to Leopoldville, Belgian Congo.

Petroleos Mexicanos.—155 miles, 10-in., under way, Minatitlan to Salina Cruz, Mexico.

Societe des Transports Petroliers par Pipe Line.—140 miles, 10-in., under way, Le Havre to Paris, France. Entrepose, contractor. Completion date 1952.

State of Cundinamarca, Colombia.—120 miles, 6-in., Puerto Salgar to Bogota, Colombia; Williams Brothers Co.; David Louthen, manager, Bogota.

Trans-Northern Pipe Line Co.—400 miles, proposed, Hamilton, Ont., to Toronto, Ont., to Montreal, Que., Canada.

Foreign Natural-Gas Pipe Lines—Planned and Under Way

Azienda Generale Italiana Petroli.—110 miles, 12-14-16-in., planned, Cortemaggiore to Genoa.

Azienda Generale Italiana Petroli.—145 miles, 14-16-in., under way, Cortemaggiore to Torino. Completion date 1951.

Canadian Delhi Oil Co. (Subsidiary Delhi Oil Co.).—2,132 miles, proposed, Alberta, Toronto, Montreal.

Canadian-Montana Pipe Line Co.—68 miles, 4-16-in., under way, Pakowki Lake field to Alberta-Montana border.

Direccion General del Gas del Estado.—310 miles, 8-in., under way, Plaza Huincul to Neuquen, Argentina, to the vicinity of General Conesa, Argentina.

Northwest Natural Gas Co.—950 miles, 24-in., planned, Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.

Northwestern Utilities, Ltd.—35 miles, 16-in., authorized, Viking to Shonts, Alberta.

Petroleos Mexicanos.—205 miles, 16-in., considered, Monterrey to Torreon, Mexico.

Petroleos Mexicanos.—260 miles, 20-in., under way, Monterrey to Tampico and Poza Rica, Mexico.

Petroleos Mexicanos, Mexican Gas Co., and Industrial Gas Co.—600 miles, planned, Reynosa, Tamaulipas, to Tampico-Poza Rica, Mexico.

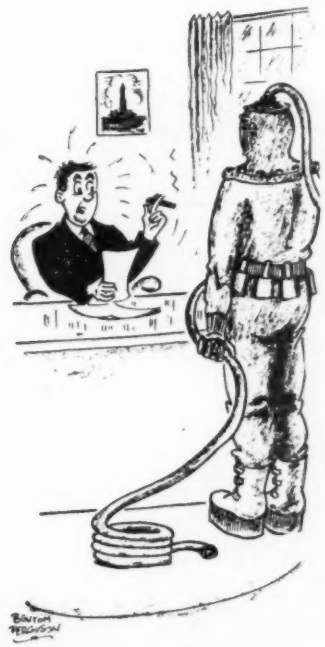
Trans-Canada Pipe Lines, Ltd.—Proposed, Alberta to Toronto to Montreal.

Venezuela Atlantic Transmission Corp.—195 miles, 10-12-16-in., under way, El Placer near Las Mercedes, State of Guarico to Caracas, La Guaria, Maracay, and Valencia. Contracted by Williams Brothers, de Venezuela, S.A., B. E. Barnes, manager.

Westcoast Transmission Co., Ltd.—1,110 miles, 24-in., planned, Dawson Creek, B. C., through Pine Pass and Fraser River Valley to Kamloops, Princeton, and Vancouver to Portland. Ford, Bacon & Davis, engineers.

Westcoast Transmission Co., Ltd.—280 miles, 20-in., planned, Pincher Creek to Montana on to Spokane, Wash. Ford, Bacon & Davis, engineers.

Western Pipe Lines.—1,033 miles, 24-in., proposed, from Southern Alberta, eastward across the Canadian Prairies, serving principal towns and cities along the route to a point near the International Boundary.



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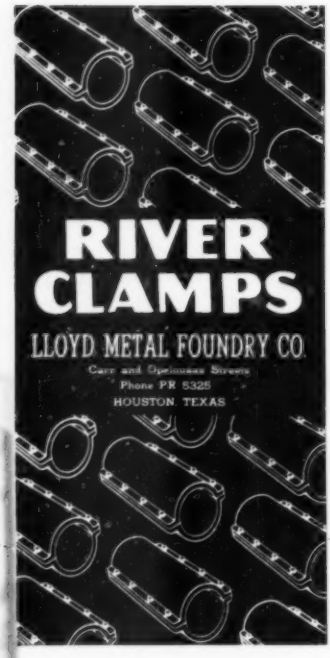

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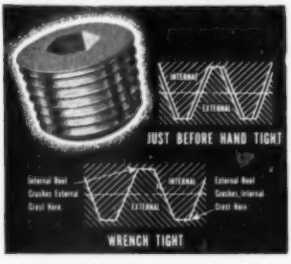

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PIPE LINES

Standby Line

Transco completes 24-in. crossing of Arthur Kill

NEW YORK.—Transcontinental Gas Pipe Line Corp. has completed the first of the two major river crossings involved in the construction of its auxiliary natural-gas line into the New York City area.

The crossing consisted of laying 1,700 ft. of 24-in. line under the Arthur Kill between Gulfport, Staten Island, N. Y., and Linden, N. J. The other crossing will be under the Narrows of New York Bay and will carry the line on into Brooklyn.

Transcontinental's 30 and 26-in. line from the Texas Gulf Coast was completed about a year ago and began deliveries into New York City. The 1,840-mile line, the world's longest, ended with a single crossing of the Hudson River at a metering station at 134th Street in the metropolitan area.

Transcontinental was planning construction of the alternate line even before its main system was completed. The new connection extends from the company's main line at East Carteret, N. Y., across the Arthur Kill, Staten Island, the Narrows, and into the Bay Ridge section of Brooklyn. Total length is 11.56 miles; cost is approximately $3,585,000.

Floated across.—The flotation method was employed in laying the pipe across the Arthur Kill. A 20-ft. deep trench was dredged below the bed of the river by Arundel Dredging Co., and the 24-in. line was protected by a concrete coating applied by H. C. Price Co. S. V. Collins, president of Collins Construction Co., supervised the crossing operation. Contractor for the extension is Samuel Gallucci & Sons, Inc.

The Narrows crossing will be of particular interest because of its length and depth. At some points, the pipe line will be laid 100 ft. below the surface of the water. The Narrows is the constriction between Upper and Lower New York bays through which passes the shipping into this world's largest port.

Another auxiliary line to the Transcontinental system is the second crossing of the Delaware River near Marcus Hook, Pa. This $1,123,415 project, authorized by the Federal Power Commission last June, provided for 7,200 ft. of 12¾-in.

FPC Approves New 30-In. Gas Line in California

LOS ANGELES.—The Federal Power Commission has authorized

NEARING THE END.—With about 3 miles left to go, a dope gang is shown pushing ahead through hilly country during construction of looping by Panhandle Eastern Pipe Line Co. near Montezuma, Ind.

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BY PIPELINE MEN

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Southern California Gas Co. and Southern Counties Gas Co. of California, both of Los Angeles, to build and operate natural-gas-transmission lines in this area.

The companies will build a new 23½-mile, 30-in. line from Inglewood to Los Angeles, half of it owned by Southern California Gas and the other half owned jointly by the two companies. The project would cost Southern California Gas an estimated $2,288,169 and Southern Counties, $323,706.

The companies also will operate an existing 15-mile section of 30-in. line from Rivera Junction to Inglewood. Southern California Gas also received permission to operate an existing 4-mile section of 18-in. line in Los Angeles.

Christmas Checks Delivered To Pump Stations by Plane

A pipe-line patrol plane dropped pay checks at 20 pump stations of Gulf Refining Co. last week when mail congestion threatened to prevent delivery before Christmas, according to P. L. Reichard, general superintendent, Tulsa pipe-line division.

At all Gulf stations and delivery terminals from Pryor, Okla., to Lima and Cincinnati, Ohio, the pay checks for the first half of December were dropped in cardboard boxes from a plane of Airplane, Pipe Line Patrol Co., a division of Gleason Romans Aviation, Inc., which contracts the regular patrolling of the Gulf line for the detection of leaks and erosion of the right-of-way.

Ham-Gossett Outlet Near

ATHENS, Tex.—Humble Pipe Line Co. has started unloading pipe for its new 15-mile, 4-in. outlet from the expanding Ham-Gossett multiple-pay field in Kaufman County northwest of here.

The line will run south from the field to the Flag Lake area in west Henderson County which is already linked with the Humble trunk near Corsicana. Ham-Gossett now produces about 75,000 bbl. of crude per month. Oil is being trucked to Flag Lake temporarily.

Pipe-Line Brief

Joint use of petroleum-radio facilities by two companies has been approved for the first time by the Federal Communications Commission, permitting the Michigan-Wisconsin Pipe Line Co. and the Michigan-Consolidated Gas Co. to share the use of microwave frequencies and facilities on the northeastern end of the former's radio-communication network from the Panhandle and Hugoton gas fields in Texas and Kansas to the industrial areas of Wisconsin and Michigan.

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The locked-in strength of Tri-Lok enables it to stand up under heavy loads—even on long spans. Get maximum strength, air and light with minimum weight.

Tri-Lok is also available in Diagonal, or Super-Safety U-type Flooring, and in Stair Treads of all types. Write for Bulletin MM 1140.

The Tri-Lok Company is also equipped to furnish *riveted* and Tri-Forge *welded* open steel flooring. Tri-Lok can be furnished in a variety of metals, including aluminum alloy, stainless steel, etc.

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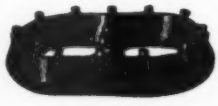

Oil field drilling practices often require the operation of boilers at 400% or more of rated capacity. INFERNO steam stack blowers will secure these maximum capacities—blowers permit boilers to be operated up to 432% of rated capacity. High velocity for efficient boiler firing is assured with Inferno stack blowers. Body is malleable iron and nozzles are stainless steel for durability and long life under rough treatment. Buy through your supply store. Write for Bulletin 22-A explaining operation.

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REFINING

Phillips to Start at Once On Big Petrochemical Plant

HOUSTON.—Phillips Petroleum Co. will start construction at once of a large new petrochemical plant here.

The new plant will be built by Phillips Chemical Co., Phillips subsidiary, on a 500-acre tract adjoining the present 340-acre site of the company's ammonium sulfate plant at Adams Terminal on the Houston Ship Channel. The new facilities will serve as a base for the future manufacture of a wide variety of petrochemicals.

The plant is the same one projected by Alamo Chemical Co., a joint venture of Phillips, General Aniline & Film Corp., and Borden Co. Phillips now has acquired all interests in the plant. As originally planned, the installation would have produced ammonia, methanol, and other chemicals.

Eldorado Refining Plans $3,000,000 Plant Expansion

ELDORADO, Kans.—Eldorado Refining Co. has awarded contracts for construction at its refinery here totaling more than $3,000,000 to Refinery Engineering Co., Tulsa.

The program will involve construction of a catalytic cracking unit, a gas-concentration plant, and revamping of the polymerization plant to handle increased charge stock from the new cracker.

The new plant will be able to process cracking stock from 10,000 bbl. of crude per day and will be designed to increase capacity to 15,000 bbl. per day if necessary. The plant now handles 9,000 bbl. per day.

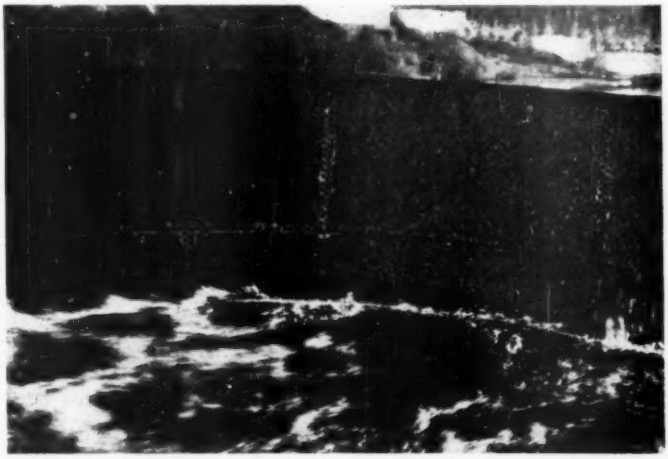
The present thermal cracking unit at the refinery will be maintained intact as a standby and to control the production of middle distillates in response to market demand.

The expansion program will double the refinery's consumption of electricity and water. The company plans to bring production of higher octane motor fuels and distillate fuels as soon as the cracker is placed in operation.

Tide Water to Build New Crude Still at Drumright

DRUMRIGHT, Okla.—Tide Water Associated Oil Co. will begin work early in 1952 on a new crude-oil distillation unit at its refinery here.

Edward H. Salrin, vice president, said the still is designed to process 15,000 bbl. of crude per day and will include both atmospheric and vacuum distillation units. It will produce motor gasolines, burning oils,



CRUDE FIRE CONTROLLED.—A free-blazing tank of crude oil shooting flames high in the air was brought under control rapidly during tests last month of a new fire-fighting method at Socony-Vacuum Oil Co.'s Olean, N. Y., refinery. Flames in the tank have here been reduced to about 12 in. above the surface of the oil, thereby enabling fire fighters to approach near enough to finish the job using mechanical foam. The method, most effective when used on fires of low flash-point liquids, involves injection of compressed air below the surface of the blazing liquid (The Oil and Gas Journal, December 20, page 182).

and charge stock to the cracking units.

Born Engineering Co., Tulsa, has contract for construction, and plans call for completion before the end of 1952.

C.C.A. Awards Contracts to Expand Phillipsburg Plant

KANSAS CITY.—Consumers Cooperative Association has let contracts to Refinery Engineering Co., Tulsa, to double the 4,000-bbl.-daily throughput of its Phillipsburg, Kans., refinery and to install catalytic cracking and polymerization units.

Howard A. Cowden, president of C.C.A., said the multimillion-dollar improvement and expansion program should be completed by February 10, 1953.

The Phillipsburg plant is the first cooperative-owned refinery in the United States.

Tests Show Oil Shale Loses Little Oil During Exposure

WASHINGTON.—Studies of Colorado oil shales by the Bureau of Mines show that ground shale stored in the open and exposed to normal weather conditions suffers insignificant loss of oil content after exposure up to 6 months. After exposure for 5 years, the shale shows a loss of only around 11.4 per cent.

Tests of 16 rough, rocky oil shales with colors ranging from gray brown to dark brown developed that the dark brown shale assayed 75 gal. of oil per ton while the gray brown gave only 10.5 gal. The shale used in the study was obtained from Mahogany Ledge, the richest part of the Green River formation near Rifle, Colo. The shale here is considered the most suitable section for commercial exploration, with an average yield of about 30 gal. per ton.

The organic material in shale beds suitable for mining yielded, on the average, 66.3 per cent oil, 9.1 per cent gas, and 24.6 per cent organic residue. The Mahogany Ledge shale bed alone covers an area of 1,000 sq. miles and represents an estimated 100,000,000,000-bbl. oil reserve. The entire Green River formation covers an area of about 16,500 sq. miles in Utah, Colorado, and Wyoming.

Results of the bureau's studies are summarized in Report of Investigations 4825, "Properties of Colorado Oil Shale," copies of which may be obtained without charge from its Publications-Distribution Section, 4800 Forbes Street, Pittsburgh 13.

Oil-Refining Dividends Drop Sharply in October

WASHINGTON.—Cash dividends paid by oil-refining corporations in October dropped to $8,600,000 from $20,600,000 in the same month last year, but the Department of Commerce, reporting on dividend payments, explained that irregular dividend action by major corporations was responsible for the decline.

The October drop was more than offset by earlier dividends, it was indicated, since total payments for the first 10 months of this year were $623,800,000 compared with $510,500,000 for the corresponding 1950 period.

The $113,300,000 increase in refining-company dividends, the department pointed out, was more than half of the increase in the dividend payments of all manufacturing corporations for the 10-month period.

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McCORD CLASS S.F. LUBRICATORS

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MURPHY Switch Model -45 for Triplex Oil Well Pumps shuts down pump *automatically* when

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This model is also widely used as safety shut down on gas compressor plants & pipeline pumps.

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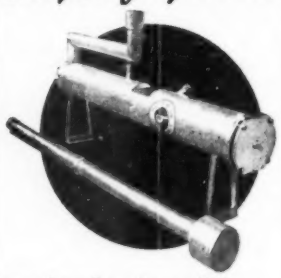

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MANUFACTURERS OF OIL FIELD EQUIPMENT
Box 1366 Monahans, Texas

Among the Drilling Contractors

Brunson Elected Head Of Kansas Contractors

William S. Brunson, Brunson Drilling Co., Wichita, has been elected chairman of the Kansas section of the American Association of Oilwell Drilling Contractors. He succeeds J. G. Adkins, Adkins Drilling Co., Great Bend.

Other new officers are: Lloyd Pickrell, Pickrell Drilling Co., Wichita, vice chairman of the Wichita area; C. L. Roberts, B & R Drilling Co., Russell, vice chairman for western Kansas; and B. W. Burks, Rocket Drilling Co., Wichita, secretary-treasurer.

New Drilling Partnership

Henry Gist, formerly a partner in the drilling firm of Lovell & Gist, Denver and Casper, and Charles F. Dougherty, formerly associated with R. L. Manning Co., Denver, have formed a new drilling partnership to operate as Gist & Dougherty. Headquarters have been established at Casper.

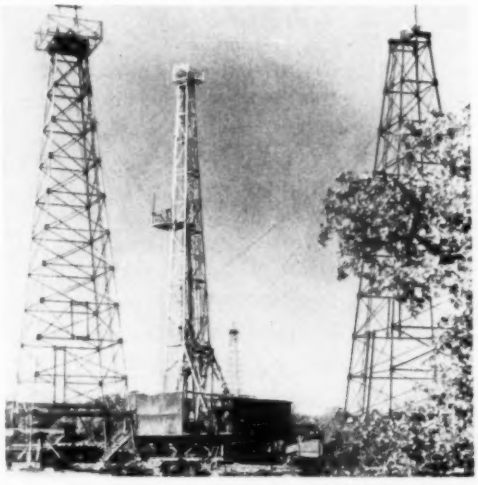
Anschutz Drilling Co., Wichita, has skidded its rig from the dry hole just completed for Sunray Oil Corp. at 1 Hotaling, a wildcat test in the W½ NE SW 27-9n-43w, Phillips County, Colorado, and will drill another test for the same company at a location 200 ft. west. The first test was quit at a total depth of 4,977 ft. Although commercial production was not developed, the test had showings in several zones.

Pike Drills 98.9 Miles Of Hole in Year's Time

Thomas P. Pike Drilling Co., Los Angeles, reports that it drilled 522,449 ft. (approximately 98.9 miles) of hole during its last fiscal year. Wells drilled totaled 132, averaging 3,882 ft. per well. Six of the wells were in Mexico, five being in the Reynosa area in the northern part of the country and one in Baja California. The remainder were in California. The company currently is operating 15 rigs, 14 in California and one in West Texas.

Longhorn Drilling Corp., San Antonio and Three Rivers, Tex., has the contract to drill a 7,400-ft. Wilcox test for Tide Water Associated Oil Co. in the North Karon field, Live Oak County, South Texas. Location is to be known as 1 E. A. Emerson, and is in the AB&M Survey, about 6 miles east of Oakville.

Justiss-Mears Drilling Co., Jena, La., is starting a Wilcox sand test for Richard W. Norton, Jr., and Gulf Refining Co. at a wildcat location 3 miles northeast of Colfax, in Grant Parish, northeastern Louisiana. Location is in the C NE NE 34-7n-3w, on the operators' Edenborn lease. Contract is for 5,300 ft. This contractor also is drilling a wildcat test south-



ACTIVITY. — Development of new productive horizons in older fields of southern Oklahoma is providing much additional work for contractors. Here, a modern, mast-type rig (center) of D & D Drilling Co., Oklahoma City, is exploring lower pay zones in the midst of old wells in the Graham-Fox field, in Carter County.

Baash-Ross News

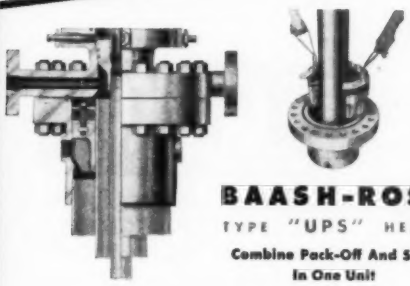
HOUSTON • OKLAHOMA CITY • NEW YORK

OUR 32nd YEAR

ere's what BAASH-ROSS has done o simplify your well head problems!

THREE BASIC TYPES OF UNITS MEET EVERY OPERATOR'S REQUIREMENTS

For many years Baash-Ross has been a leader in the development of more compact, more efficient Well Head Equipment. And to meet the varied requirements of present-day operations, Baash-Ross now offers three basic types of Head Assemblies—each offering certain vital advantages to save time, space, and money on your development programs . . .



BAASH-ROSS

TYPE "UPS" HEADS

Combine Pack-Off And Slips In One Unit

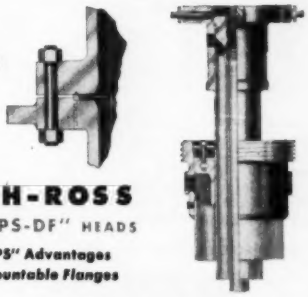
Type "UPS" Heads—a new Baash-Ross development—have the Packing Element and Slips unitized into a *single* hinged assembly that simply w-r-a-p-s around the casing and locks in place with one bolt. As the weight of the casing is placed on the slips, they *automatically* equalize themselves within the bowl to assure exact centering of the casing as well as a uniform grip around the *entire circumference* of the pipe. A few quick turns of a wrench then expands the packing element for a pressure-tight seal.

"UPS" ADVANTAGES INCLUDE . . . (1) No space wasted by threads, grooves or other packer-retaining devices—therefore overall height is reduced to a minimum . . . (2) Elimination of threads, grooves, etc., means a smooth bowl—nothing to become damaged during drilling operations, no need for protective sleeves . . . (3) Since all the slip segments are unitized together, none can set higher or lower than the rest—no risk of crimping the casing, no danger of an unequal grip that may fail in service . . . (4) Slips are set and packing is tightened around casing without stripping and without first cutting the casing. Simplifies installation—saves time!

"UPS" Heads also incorporate the unique Baash-Ross weld-testing feature which permits simultaneously testing the pressure-tightness of *both* casing welds with a gauge and hand pump as part of the installation procedure—or any time later. Any leaks discovered during the life of the well can be quickly sealed off by injecting plastic pack material.

"UPS" Equipment is available in a complete range of sizes . . . for threading or welding to the casing . . . with or without Bases . . . and for use with over a dozen different Tubing Heads Suspensions and Hook-Ups. *It is the ideal solution for a wide range of requirements on medium and low-pressure wells!*

View of Flange installed showing packing arrangement.



BAASH-ROSS

TYPE "UPS-DF" HEADS

Offer "UPS" Advantages *Plus Demountable Flanges*

Type "UPS-DF" Heads combine all the "UPS" advantages with an additional important feature—*Demountable Flanges that can be salvaged after the drilling operations for use on other installations.*

The body, packing and slips of this design are the same as standard "UPS" Heads to provide all the important "UPS" advantages outlined at left. However, the flange is attached to the main body by means of a square thread so that it can be readily removed when drilling operations are completed.

During drilling, the flange is installed on the Head to provide means for attaching standard pressure control. A unique packing arrangement—having important advantages over the conventional ring-groove design—prevents leakage between the flanges and is so placed that the square thread is not exposed to casing pressure.

After drilling is completed, the pressure control equipment is removed and the flange is unscrewed from the Head—an operation simplified by the easy make-and-break properties of the square thread. The flange, ring bolts and packing can then be used repeatedly on other wells, thus effecting important economies on multiple installations.

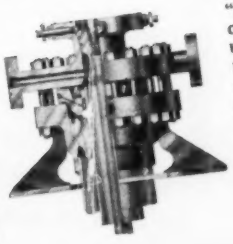
Available in a complete range of sizes and designs, Type "UPS-DF" equipment is the latest in a long string of Baash-Ross Landing and Casing Head advancements. *Be sure to investigate the economies this equipment can make for you!*

BAASH-ROSS TYPE "X" HEADS **Provide Vital Advantages for High-Pressure Installations.**

Developed several years ago to give new efficiencies on high-pressure wells, Type "X" equipment has been widely used on wells of all depths and pressures. It offers an unusual degree of simplicity, compactness and ready-adaptability to different installation requirements, and the heavy-duty pack-off provides a dependable seal against the highest well pressures. The pack-off is made in a separate unit that fits between flanges—a pressure-tight seal being formed around the casing by a double-element Packing Assembly tightened by stud bolts.

TYPE "X" ADVANTAGES INCLUDE . . . (1) No grooves or threads in the bowl of the Head—therefore nothing to become damaged or corroded during drilling operations, nothing to require maintenance or protection . . . (2) The one-piece Packing Assembly mounts between flanges for simple installation, maximum saving in space . . . (3) Unitized Slips assure uniform slip pressure, freedom from casing damage . . . (4) The Packing Assembly as well as the casing weld are so designed that the seal around the casing can be checked at any time during the life of the well, and if a leak is discovered can be readily packed-off with plastic material *without dismantling the Head or even breaking connections.*

Type "X" Heads are unusually adaptable to varying completion requirements—permit changing series-ratings and flange sizes in the Heads—and have many other unique features. They are available in a complete range of sizes, pressures and variations to meet every well requirement!



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Baash-Ross Landing, Casing and Tubing Heads are available through leading supply stores.

See pages 421 through 430 of your 1951 Composite Catalog for more data on Baash-Ross Landing and Casing Heads. Or write to your nearest Baash-Ross Sales Office

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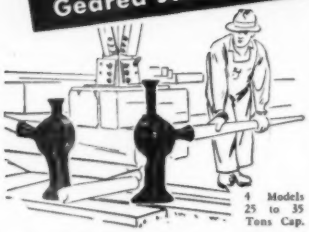

4 Models 25 to 35 Tons Cap.

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east of Rogers, in LaSalle Parish. The latter, 2-D Nebo, in 6-6n-3e, is being contracted for J. S. Michael Co. and Ashland Oil & Refining Co. It also is going to the Wilcox.

Glasscock Drilling Co., Shreveport, has moved a heavy-duty rotary rig to a wildcat location 14 miles east of Marksville, Avoyelles Parish, Louisiana, where it is under contract to Pan American Southern Corp. for a 9,300-ft. test, 1 Southwestern, in the C NW SW 1-2n-6e.

Crescent Drilling Co., Monroe, La., has been awarded the contract for the deep wildcat test which Southwest Gas Producing Co., Inc., and W. C. Feazel have projected for southern Lincoln Parish, Louisiana. Location is 5½ miles east of the Simsboro field on the operators' Redwine lease in 11-17n-3w. Contract is for 10,500 ft.

R. L. Manning, Denver, has contracted for a well to be drilled on the old Teapot Dome naval reserve, 40 miles north of Casper, in Natrona County, Wyoming. The well, to be designated as U. S. Navy 1-G-10, is the first to be drilled on the reserve in 25 years. Hole will be carried to the granite. Location is in the NW NE SE 10-38n-78w.

Parker Drilling Co., Tulsa, is starting work on a new contract with Max Pray and associates calling for an outpost test on the west flank of the Elk City field, in Beckham County, western Oklahoma. Location, on state land, is in the C NE SE 11-10n-22w. Parker also is starting a new well for United Carbon Co. in the southeast extension area of the Elk City field, in Washita County. The new project is 1 Morgan, C NE SW 28-10n-20w. Rig has been moved to the location from 1 Lucy Music recently completed as the operator's second producer in the area. The latter was drilled to 10,453 ft. and completed in a 9,700-ft. zone.

ACTIVE ROTARY RIGS*

(United States and Western Canada)

Area—	Week ended 12-17-51	Change week ended 12-10-51	Change week ended 12-18-50
Gulf Coast	641	—26	+ 57
W. Tex.-N. M.	1,053	—16	+249
Ark.-N. La.-E. Tex.	197	+ 2	+ 36
Oklahoma	379	+ 7	+ 56
Kans.-S. Neb.	211	+ 8	+ 42
Illinois-Eastern	134	—12	+ 26
Rocky Mountains	194	+ 4	+ 80
Pacific Coast	185	+ 6	+ 53
Total U. S.	2,994	—27	+599
Western Canada	171	+11	+ 48
Total	3,165	—16	+647

*Courtesy Hughes Tool Co. Trends in drilling activity in the United States and the Rocky Mountains and western Canada areas are shown on pages 118 and 119.

Nuckolls - Bell Drilling Co., Oklahoma City, is moving a rig to a wildcat location 4 miles east of Guthrie, in Logan County, Oklahoma, where it will drill a Wilcox sand test for Foundation Oil Co. and associates. Location is for 1 Walters, in the SE SW NW 10-16n-1w. Contract is for 5,750 ft.

Prime Drilling Co., Wichita, has taken on a rank wildcat job in southern Sheridan County, Kansas, where it will drill for M. B. Armer, Harry Koplin and Glickman Oil Co. Location of the test, 1 Bieker, is 12 miles south of Hoxie, and about the same distance north of Gove, Gove County, in the NW NW NE 15-10-28.

VARCO

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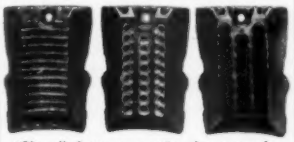

"Varco" buttons, popular for years in rotary drill pipe slips, proved satisfactory and have been adopted and are installed in segments of automatic casing spiders and elevators of various makes. Wickers are removed and holes bored for a maximum number of VARCO casing buttons, to assure uniform and maximum gripping area. Converting buttons for the next smaller casings are available. Write for complete descriptive data.

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HOUSTON

NATURAL GAS

California Facing Shortage Without More Gas Imports

SAN FRANCISCO.—The California Public Utilities Commission claimed last week that the possibility of a future shortage of natural gas in California is very real unless more out-of-state gas is imported.

This is despite the fact that the state now imports more than one-third of its current natural-gas needs from Texas and New Mexico.

The possible shortage was forecast after the commission sifted findings from public hearings held by Harold P. Huls, commissioner, and Manley Edwards, examiner.

The commissioner decided that California is well advanced on a transition from an area with plenty of gas to an area without. The state has not had a surplus of natural gas since before World War II. The imposition of heavy civilian and military defense loads on growing domestic demands has aggravated the situation, the commission said.

New York Conversion Halted Until Standby Line Is Built

ALBANY.—Consolidated Edison Co. has been ordered to halt conversion in New York from manufactured to natural gas by New York Public Service Commission. The commission said that conversion will be prohibited until adequate standby facilities are set up to carry gas into the area.

Consolidated Edison completed a changeover to natural gas last September in small areas of Queens and the Bronx and all of Westchester County. It serves about 1,200,000 customers in Manhattan, the Bronx, part of Queens, and Westchester County.

The company recently asked the commission for permission to convert other sections affecting about 17,000 customers. The commission denied the petition until such time as Transcontinental Gas Pipe Line Corp. completes additional or alternate facilities which could be used in the event of a break in the single line from Texas to Manhattan.

Transcontinental last week said it expects to place an auxiliary line from Linden, N. J., into the New York area in service by early spring.

Panhandle's Industry Sales Held Subject to Regulation

CHICAGO.—The Illinois Commerce Commission ruled last week that Panhandle Eastern Pipe Line Co.'s sales of natural gas direct to industrial customers in Illinois are subject to state regulation.

The commission said that Panhandle, in acquiring new direct-service industrial customers, frequently has engaged in active competition with public utilities in Illinois engaged in such competition through "its monopoly over the supply of natural gas along its lines."

The commission said Panhandle's industrial sales in the future in Illinois will be subject to the same regulations as those by local public utilities. It ordered the company to file schedules of its rates and charges and to comply with provisions of the Illinois Public Utilities Act.

Texas Panhandle Prices Up

AUSTIN.—Producers of natural gas in the Texas Panhandle are getting about 1 cent more per M.c.f. than they were a year ago.

The Texas Railroad Commission reported that the average price paid for sweet gas early in November of this year was 5.7944 cents per M.c.f. on a 16.4 psi. pressure base. In November 1950 the price averaged 4.8526 cents.

Sour gas is bringing about .5 cent less, the commission said. The commission is required by Texas law to make a semiannual report on average prices for Panhandle field gas.

Natural Gasoline

Cavern Completed

Cities Service's Lowell project storing propane

LOWELL, Mich.—One million gallons of propane will be stored this winter in Cities Service Gas Co.'s newly completed underground L.P.G.-storage cavern near here. After winter demands have depleted the current underground-storage supply this season, the cavern will be enlarged to provide a storage capacity of 4,000,000 gal.

From this plant, distribution of L.P.G. will be made to consumers on a short-haul basis by truck transport or in bottles. Aboveground facilities at this plant include a small amount of conventional aboveground steel storage, bottling truck and rail-loading facilities and a small office.

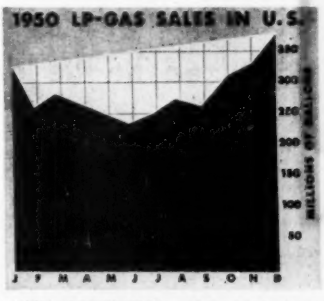
Salt deposit.—The Lowell project is located in a massive salt deposit reached by conventional drilling last April at a depth of 3,798 ft. The salt bed was penetrated 250 ft. and 7-in. casing set at 3,791 ft., 7 ft. above the salt.

The cavern was excavated by circulation of fresh water through the tubing and out the annular space between the tubing and the casing. On an average, one barrel of cavern storage was dissolved out of the salt for each 6 bbl. of water circulated and withdrawn. Two methods were employed in making the cavern, one by injection of water down through the tubing for directional washing at the bottom and the other by reverse circulation through the annular space for widening the cavern.

Injection operations.—With the approach of winter, washing operations were discontinued and propane injection commenced. First propane injected came from the company's Pampa, Tex., plant. Injection is conducted at a pressure of 1,200 psig. in the annulus.

To withdraw propane, water will be injected down the tubing and the propane will be drawn out through the annulus. Rate of propane withdrawal will average approximately 200 gal. per minute.

Cities Service is studying the feasibility of conducting similar underground storage projects at other locations. By virtue of joint ownership in other plants, the company has underground-storage facilities at North Snyder, North Cowden, and Dollarhide gasoline plants in West Texas where similar L.P.G. storage projects are in operation in Permian salt deposits.



***LOST PRODUCTION.**—This chart shows the spread, 629,000,000 gal. in 1950, between L.P.G. sales (lower line) and production (top line). The difference represents product "lost" because of lack of immediate markets or adequate storage facilities, according to developers of the chart, the LP-Gas Information Service. As might be expected, the largest differential between the two occurs during the summer months when there is no comparable load to offset heavy winter demands. In an attempt to lick the problem, the industry has launched a program to encourage use of larger storage facilities in northern areas where winter use of L.P.G. is heaviest.*

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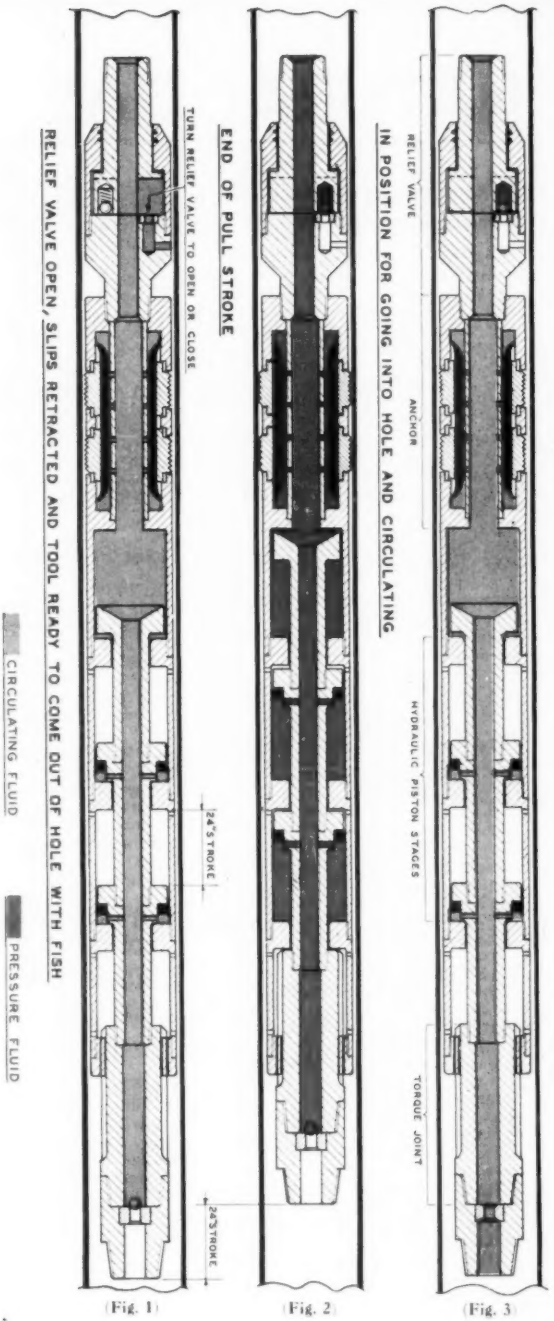
RELIEF VALVE OPEN, SLIPS RETRACTED AND TOOL READY TO COME OUT OF HOLE WITH FISH
TURN RELIEF VALVE TO OPEN OR CLOSE
CIRCULATING FLUID
PRESSURE FLUID
24" STROKE
24" STROKE
END OF PULL STROKE
IN POSITION FOR GOING INTO HOLE AND CIRCULATING
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TORQUE JOINT

(Fig. 1) (Fig. 2) (Fig. 3)

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Exploration and Drilling

Are We Running Out of Oil?

THAT is a question being asked as 1951's record-high, long-considered-impossible production rate is being reviewed. That is also a question that has been asked from time to time ever since the tremendous importance of petroleum in the economy of this nation was realized during World War I. What's the answer?

There are many reasons that can be pointed out why this country is approaching its peak year of production and not one you can put your finger on why it isn't. Just because during the past 30 years some have been saying that production is approaching a peak and yet here we are at the end of an all-time high year of production with more proven reserves than ever before, isn't any reason why production won't start downhill tomorrow, next month, next year, or within the next 10 years.

What are those reasons why production should reach a peak within the next 10 years? Known prospects are getting smaller and new prospects are becoming increasingly difficult to find. It takes more manpower, more feet of hole, and more, lots more, money to find a barrel of oil today than it did 20 years ago. Oil is being sold for less than it costs to replace it. There has to be an end sometime and current producing rates might be interpreted as a final surge before the downward trend begins.

Now let's look at the opposite side—the things you can't put your finger on, the same type of things that have kept production climbing and climbing until this year nearly 2¼ billion barrels of oil were produced, one-quarter of all the oil estimated to have been on reserve in 1921.

Half the sedimentary area in the United States has yet to be explored as vigorously as have areas where oil has been and is being found. There's no reason why this "untouched" half shouldn't yield just as much oil as the producing portion. Many reasons can be given why it won't, but all of these reasons are based on unproved theories on the origin, migration, and accumulation of oil, about which all too little is known.

Nature's oil storage "tanks" are being drained and, as far as is known, Nature is not replenishing them at a rate at all comparable to withdrawals. This draining began a couple of thousand years ago by cupfuls, only 100 years ago by bucketfuls, about 60 years ago by tank carfuls, and now by a network of pipe lines with a capacity that staggers the imagination.

Someday Nature's tank farm is going to stop yielding an ever-increasing amount of oil, but those who think the next few years will see that day underestimate the size of that tank farm.

Prior to the twenties, geologists with their alidades and plane tables saw only the tank reflected on the surface, they saw a better hidden tank when geophysics entered the search, a third tank when geophysicists and geologists began working together and when stratigraphic traps were recognized. Today, before any one of those tanks is depleted, a fourth is being opened. Prejudices are being laid aside as oil searchers are going back over old areas, drilling deeper, and moving into "condemned" and remote regions. Another 30 years or so may see production from this tank start to decline, but by then a sixth tank will be tapped. Just what ideas or means will be used to locate this tank is impossible to say. (Geophysical methods and stratigraphic traps were unknown 30 years ago—what will have been unknown in the early fifties when history of petroleum exploration is recorded in 1980? Searching for oil with radio waves cannot be discarded lightly despite present opposition. Direct means of locating oil are not considered impossible—they may be closer than most realize).

Perhaps of all the developments in exploring for oil during the past few years, the most outstanding have been those which have knocked the cockiness out of the searchers. True wildcats no longer have an objective horizon, oil is their objective and every foot from surface casing shoe to granite is looked upon as a possible pay. Even field wells are being drilled with this wildcat attitude.

To answer the opening question, using steel requirements as the only hedge—peak production in the United States is not in the foreseeable future. That's judging the future by the past—not in number of barrels produced, not because we've always found more, but because the past has shown that oil is where it couldn't be, but was; hidden where it couldn't be found, but was; or located where it was uneconomical to produce, but has been.

If you have any ideas on the subject, pro or con, let's hear them.

Philip C. Ingalls.

HIGHLIGHTS OF WEEK'S DEVELOPMENTS

SOUTH LOUISIANA.—Magnolia Petroleum Co. has broken South Louisiana's depth record at a wildcat located 1½ miles southeast of Hurricane Creek field in Allen Parish. The well, 1 Ragley Lumber Co. "D," 29-5s-7w, is now bottomed at 17,481 ft. and operator is running electric log. The well has 7-in. casing set at 13,824 ft.

WEST TEXAS.—Humble Oil & Refining Co. 1 Pearl Williams, Strawn discovery in southeast Irion County, flowed 143 bbl. of clean, 45°-gravity oil in 2 hours and 7 minutes on drill-stem test at 7,230-7,354 ft. Honolulu Oil Co. 1 Sugg, first Spraberry well for Sterling County, completed for 304 bbl. of 42°-gravity oil a day, without acid treatment. Potential was based on 122-bbl. flow in 8½ hours through 5/16-in. choke.

ROCKY MOUNTAIN AREA.—Husky Oil Co. and Wilshire Oil Co. have tested gas in top of Phosphoria at Five Mile, Wyoming, wildcat. Gulf Oil Corp. is testing shows of oil in Third Frontier at nearby Worland prospect, Washakie County. Harold Barnes, Bruce Anderson, et al., of Casper recovered oil on test of the Tensleep at North Casper Creek, Wyoming, wildcat for the third recent Tensleep discovery in this general area.

Rocky Mountain

Two Wildcats Show for Oil in Big Horn Basin

DENVER.—Two new wildcats in the Big Horn basin of Wyoming have found oil and gas on tests, and indicate possible important discoveries.

The Husky Oil Co.-Wilshire Oil Co. 1 Torgeson, C NE NE 29-49n-93w in the Five Mile area, topped Phosphoria at 11,645 ft. and on test 11,648-78 ft. there was gas at the surface in 30 minutes, estimated flow 4,000,000 cu. ft. daily. Recovery was 10 ft. of oil, 400 ft. of water and 540 ft. of gas-cut mud.

Husky is coring ahead below 11,688 ft. in Phosphoria. Phosphoria and Frontier are producing formations at Worland field, southeast of Five Mile.

Southwest of Worland, Gulf Oil Corp. has recovered saturation in cores of the Frontier between 10,287-10,312 ft. and are now testing this zone. The well is 1 Stockham-Federal, C SE NW 2-46n-94w, Washakie County. The well made 260 ft. of distillate with distillate-cut mud on test 10,238-87 ft. and additional saturated sand was recovered below this zone. Both of these wildcats are located on seismic prospects, and commercial completion of either of the wells would probably indicate a sizable reserve, similar to that found at Worland.

The third of a series of recent Tensleep discoveries on the west side of the Powder River basin may start deeper drilling throughout this area. Tensleep (Pennsylvanian) produces in a small area of the Salt Creek field as compared to the productive area in the upper formations. However, earlier this year Continental Oil Co. completed an excellent Tensleep discovery in Sussex field, north of Salt Creek in Johnson County and is now drilling a Tensleep test at Meadow Creek. Recently Stanolind Oil & Gas Co. and Continental tested Tensleep oil at North Fork, after the well failed to produce from Cretaceous sands.

This week Harold Barnes, Bruce Anderson, and R. L. Peterson, Casper independents, recovered 2,745 ft. of clean oil and 400 ft. of oil-cut mud on test of the Tensleep at 1 Government, NE NW SE 1-36n-82w, in the North Casper Creek area, Natrona County. This wildcat is south of the Salt Creek field. The operators will complete the well at the present depth of 3,245 ft. with top of Tensleep at 3,225 ft.

In the Denver-Julesburg basin two wells have found saturation in cores and may make discoveries.

Sohio Petroleum Co.'s 1-B State, NW NW NE 34-8n-5ew, topped the J sand at 4,605 ft. and found saturation in the top 10 ft. of that formation. On drill-stem test of the zone, some oil and gas-cut mud with some water was recovered. The well is east of previous production in Logan County, and Sohio plans to run casing for further testing of the zone.

Sinclair Oil & Gas Co. 1 Parke, NW NW 6-9n-52w, another Logan County wildcat, found staining and good porosity in the first sand (D sand) topped at 4,783 ft., and operator is making drill-stem test with total depth at 4,809 ft. There have been a series of wildcat failures through Logan, Morgan, and Weld counties during the past 3 weeks. However, there have been several good wildcat discoveries in the past few months to maintain the high discovery average for this basin.

Three operators have announced wildcat locations in the Williston basin of North and South Dakota. Stanolind Oil & Gas Co. will drill in the C SW SW 28-150n-80w, McLean County, with the well a deep test of this area. Champlin Refining Co. of Enid has location at 1 Tank, C NE SE 7-156n-96w, Willimas County, on the northwest side of Nesson anticline. The well will be a 12,500-ft. Devonian test and is 10 miles northwest of Beaver Lodge, where Amerada Petroleum Corp. this week completed 1 Iverson flowing 25 bbl. of oil per hour from the Madison. In South Dakota N. D. Hunt has skidded rig and is starting 1-A State School Land, W½ SW NE 24-116n-73w, Hyde County. H. L. Hunt has location for 1 Wold, C SE SW 23-155n-81w, another of the company's series of wildcats in North Dakota.

COLORADO WILDCAT FAILURES

Logan County: Globe Oil & Refining Co. 1 Berrick, CN½ NE SW 12-6n-54w; TD 4,940 ft.; dry. Niobrara 3,875 ft., Carlile 4,246 ft., Greenhorn 4,426 ft., "D" sand 4,691 ft., "J" sand 4,777 ft.

Shell Oil Co. 1 City of Sterling, SE SE SE 25-8n-53w; TD 5,025 ft.; dry. Niobrara 3,600 ft., base Codell 4,001 ft., Muddy 4,436 ft., Dakota 4,540 ft., Lakota 4,804 ft., Morrison 4,984 ft.

True & Brown 1 McRoberts, NE NE SW 6-8n-52w; TD 4,934 ft.; dry. Niobrara 3,802 ft., Ft. Hays 4,130 ft., Greenhorn 4,398 ft., "D" sand 4,643 ft., "J" sand 4,770 ft.

Montezuma County, Johnson Canyon: Tide Water Associated Oil Co. 1 Ute, C SE SW 8-33n-14w; TD 9,505 ft.; dry. Dawota 3,220 ft., Morrison 3,365 ft., Todilto 4,330 ft., Wingate 4,350 ft., Chinle 4,820 ft., Shinarump 5,640 ft., Hermosa 7,415 ft., Paradox 8,720 ft., salt 9,260 (?) ft.

Morgan County: Benson-Montin 1 Ireland Summers, C NE SE 15-4n-56w; TD 5,605 ft.; dry. Niobrara 4,304 ft., Timpas 4,613 ft., Greenhorn 4,761 ft., "D" sand 5,003 ft., "J" sand 5,173 ft., Morrison 5,602 ft.

Phillips County: Amherst area: The Texas Co. 1 E. R. Ozman, SW SW SW 34-9n-44w; TD 3,854 ft.; dry. Niobrara 2,468 ft., Ft. Hays 2,774 ft., Carlile 2,931 ft., Greenhorn 3,080 ft., Graneros 3,033 ft., "D" sand 3,280 ft., "G" sand 3,340 ft., "J" sand 3,396 ft., Morrison 3,819 ft.

WYOMING WILDCAT SUCCESS

Johnson County, SE Meadow Creek: Sharples Oil Co. 1-A-19 Govt., NE SE NW 19-41n-77w; TD 7,762 ft.; IP pumped 20 bbl. oil per day. Fox Hills 1,805 ft., Teapot 2,435 ft., Parkman 2,810 ft., Sussex 3,910 ft., first Shannon 4,383 ft., second Shannon 4,430 ft., Niobrara 5,730 ft., first Wall Creek 6,345 ft., second Wall Creek 6,773 ft., Muddy 7,440 ft., Dakota 7,603 ft., Lakota 7,685 ft.

WYOMING WILDCAT FAILURES

Converse County, South Glenrock: Far West-Hancock-Continental 4-A Moffet, Center of 17-33n-75w; TD 853 ft.; completed as water well.

Niobrara County, NE Bridge Creek: Union Sulphur & Oil Corp. 1 Albert Crom et al, NE NE SE 15-39n-61w; TD 2,653 ft.; dry. Muddy 2,633 ft., Dakota 2,440 ft., Fuson 2,555 ft., Lakota 2,633 ft.

Weston County, Powder River: The Texas Co. 1 Oilkers, C SE SE 35-48n-67w; TD 5,918 ft.; dry. Muddy 5,684 ft., Dakota 5,882 ft.

WESTERN NEBRASKA WILDCAT FAILURES

Cheyenne County, northeast Gurley: Brown Drilling Co. 1-"A" Jergins, NW SW SE 33-16n-48w; TD 4,550 ft.; dry. First sand 4,302 ft., third sand 4,491 ft.

Southwest Dalton: Ohio Oil Co. 1 Kallhoff, NE NW NW 18-16n-49w; TD 4,783 ft.; dry. Natrona 3,785 ft., Ft. Hays 4,038 ft., Codell 4,138 ft., Greenhorn 4,318 ft., first sand 4,570 ft., third sand 4,712 ft.

West McCourt area: Brown Drilling Co. 1 H. Bailey, SW SW NW 12-16n-48w; TD 4,220 ft.; dry. Niobrara 3,378 ft., Ft. Hays 3,633 ft., Codell 3,736 ft., Greenhorn 3,912 ft., first sand 4,144 ft., third sand 4,217 ft.

Sioux County: Continental Oil Co. 1 Geo. Carpenter, C NW NW 7-26n-57w; TD 5,944 ft.; dry. Niobrara 3,401 ft., Ft. Hays 4,596 ft., Codell 4,721 ft., Carlile 4,738 ft., Greenhorn 4,834 ft., first sand 5,290 ft., Muddy 5,472 ft., Skull Creek 5,520 ft., Dakota 5,646 ft., Fuson 5,767 ft., Lakota 5,798 ft.

Morton County: St. Anthony: Phillips Petroleum & Carter Oil Co. 1 fee, TD 7,790 ft.; dry. Big Horn 6,388 ft., Red River upper Whitwood 6,495 ft., Winnipeg shale 7,176 ft., Winnipeg sand 7,315 ft., pre-Cambrian 7,766 ft.

WESTERN NEBRASKA WILDCAT SUCCESS

Deuel County, West-Big Springs: Ohio Oil Co. 1-"A" Troelstrup, C SW¼ 35-13n-43w; TD 3,314 ft.; IP flowed 4,000 M.c.f. gas per day. Niobrara 2,493 ft., Ft. Hays 2,818 ft., Carlile 2,897 ft., Greenhorn 3,018 ft., "D" sand 3,214 ft., "G" sand 3,270 ft., "J" sand 3,333 ft.

SOUTH DAKOTA WILDCAT FAILURE

Hyde County, Highmore area: N. D. Hunt 1 State School Lands & Indemnity, C SW NE 24-116n-73w; TD 1,900 ft., dry.

South Louisiana

Acadia Parish Test Opens Multipay Distillate Pool

NEW ORLEANS.—Sunray Oil Corp. has opened a new distillate-producing area in Acadia Parish west of Branch. The well, 1 Fred Loewer, 45-8s-2e, gives indications of a multipay gas-distillate reservoir, having cored a total of 68 ft. of net sand in the Hackberry formation between 10,647-11,186 ft.

Interval from 10,647-79 ft. yielded 18 ft. of sand indicative of production, 20 ft. was encountered from 10,802-92 ft., and 30 ft. from 11,149-86 ft. Firm has set 5½-in. liner at 10,682-11,969 ft. and is preparing to perforate interval 11,140-42 ft. for production tests This wildcat is located 5 miles northeast of North Crowley field production and 3 miles northwest of Branch field.

Magnolia Petroleum Co. has broken South Louisiana's drilling depth record at 1 Ragley Lumber Co. "D," 29-5s-7w, wildcat 1½ miles south of Hurricane Creek field, Allen Parish. The well is bottomed at 17,481 ft., and operator is running log. Louisiana's record holder was Placid Oil Co. 1 City of New Orleans, 22-23s-22e, which is bottomed at 16,237 ft. It is located in Lafourche Parish.

Location has been staked for an 8,750-ft. wildcat in Beauregard Parish north of Longville. Hassie Hunt Trust will drill 1 Sam R. Tritico Estate, C NW NW 27-5s-9w, in southwestern Louisiana.

The Texas Co. has failed to establish production in tests of 1 Isabel Crawford Logan, 4-3s-10w, wildcat 3 miles north of Pujo in Beauregard Parish. This well was originally scheduled to go to 11,000 ft., and firm deepened to 13,503 ft., conducting extensive tests around 12,000 ft. where 70 ft. of gas-distillate sand was reportedly encountered.

The third producer for Reeves field, Allen Parish, has been completed at Thomas Jordan, Inc., 1 Industrial Lumber Co., 25-6s-7w. The well flowed 60 bbl. of oil daily from perforations at 5,891-94½ ft. Gravity of the oil was 27°.

SOUTH LOUISIANA SUCCESSFUL WILDCATS

Cameron Parish: New pay at Mallard Bay—(OWWO)—Mar-Tex Realization Corp. 2 A. S. White, 14-13s-3w, TD 10,471 ft., perf. 10,348-70 ft., IP 67 bbl. condensate per day, 50.5° gravity, TP 3,275 psi.

St. Mary Parish: New pay at Cote Blanche Island—The Texas Co. 20 Cote Blanche Island, 15s-8e, TD 14,446 ft., perf. 14,387-14,426 ft., IP 456 bbl. oil per day, 10/64-in. choke, 29.8° gravity.

SOUTH LOUISIANA WILDCAT FAILURES

Acadia Parish: Cities Service Oil Co. 1 Winston Atteberry "B," 56-7s-1e, dry, TD 9,150 ft.

Ascension Parish: Progress Petroleum Co. 1 Picard-Mayer, 13-9s-3e, dry, TD 10,778 ft.

Avoyelles Parish: W. A. Monerief 1 Virgil Descant, 31-1n-4e, dry, TD 11,002 ft.

Hunt Oil Co. 1 Ellis Reynard, 7-3n-4e, dry, TD 8,477 ft.

Terrebonne Parish: Los Nietos Co. 2-1 State, L. L. & E., 17-23s-16e, dry, TD 11,403 ft.

California

Standard Finaling Elk Hills Deep Test in Carneros Sand

LOS ANGELES.—California is winding up one of its most active exploratory years in history, but the wildcatting has not been too fruitful. By the year's end approximately 550 exploratory wells will have been completed, of which about 60 wells will be oil and gas discoveries of some sort or other. Based on present development it appears that none of the year's new field discoveries were of sufficient importance to add materially to the state's backlog of proved drilling locations.

Developments at Elk Hills Naval Reserve, however, may prove of material benefit to the nation during times of national emergencies. Early last year a new upper Stevens sand was added to the field's producing horizons. Then in March the deep test drilled by Standard Oil Co. of California, unit operator, indicated production from the deeper Carneros sand of lower Miocene age.

This deep test, X-55 in 20-30s-23e, last week was in the process of being completed in this new pay. Drilled to 12,856 ft. to test the field's deeper possibilities, it was being completed in the Carneros at about 9,500 ft. With 9⅝-in. casing set at 9,610 ft., it was expected that Standard would complete the well below the 9,278-9,363-ft. gas zone which flowed at the estimated rate of 12,000 M.c.f. daily on a formation test last March.

An Elk Hills well, Standard 336 26-R, set a new San Joaquin Valley record for the thickness of oil sand cored. The well topped the Stevens oil sand at 5,870 ft. and cored oil pay to about 7,300 ft., about 90 per cent of which was oil sand. The well, in 26-30s-23e, was in the process of being completed.

West of McKittrick production about 1 mile, E. A. Bender et al 2 Anderson, a southwest offset to their Phacoides sand discovery, found this pay nonproductive at 5,580-5,600 ft. Drilled to 8,065 ft., the outpost cored sand with oil showings at 7,820 ft. to total depth. Late reports on the well, which is located in SE NE 15-30s-21e, showed it was being electric logged. The discovery, 1 Anderson, last week was recompleted in the Phacoides at 4,607-32 ft. for a pumping production of 178 bbl., cut 40 per cent with water.

In Cuyama Valley, Richfield Oil Corp. halted drilling at 1 J. G. James after drilling to 11,336 ft. and was preparing to test an oil show after plugging to 10,588 ft. Location of this wildcat, which is about 1½ miles southwest of South Cuyama production, is in NW SE 9-9n-26w. Richfield abandoned 3 Russell C, in 2-10n-26w or some 7 miles northeast of South Cuyama, after reaching 11,292 ft.

CALIFORNIA SUCCESSFUL WILDCAT

Kern County, ½-mile north extension to Fruitvale field: Norbel Oil Co. 1 Ansolabehere, SW NW 14-29s-27e, IP flowed 140 bbl. per day, perf. 2,880-2,911 ft., 5 per cent cut, 10/64-in. bean, TD 2,911 ft., elev. unreported.

CALIFORNIA WILDCAT FAILURES

Fresno County, Clovis area: Long & Hedges 1-7 "Well," 7-12s-21e, dry, TD 557 ft., elev. 403 ft.

Kern County, Race Track Hill area: Kern Oil Co., Ltd., 1-Z Portals, 33-29s-29e, dry, TD 968 ft., elev. 704 ft.

Strand area: The Texas Co. 1 KCL-Strand, 1-30s-25e, dry, TD 8,580 ft., elev. 330 ft.

Tunis Creek area: Standard Oil Co. of California 45-29 Tejon 3, 29-11n-18w, dry, TD 2,319 ft., elev. 843 ft.

Los Angeles County, San Fernando Reservoir area: Los Nietos Co. 1 Hartman, 1-2n-16w, dry, TD 8,194 ft., elev. 1,125 ft.

San Luis Obispo County, Cuyama area: Richfield Oil Corp. 3 Russell C, 2-10n-26w, dry, TD 11,292 ft., elev. 2,149 ft.

Mississippi

Wilkinson County Prospect Testing 6,734-40-Ft. Sand

JACKSON.—Testing operations are under way at a new indicated discovery in Wilkinson County. The well is Gulf Refining Co. 1 Crosby Lumber & Manufacturing Co., 15-4n-1w, which encountered an oil sand at 6,734-40 ft. Operator has set casing at 6,797 ft. after drilling to total depth of 6,955 ft. The wildcat is located 2 miles due west of Max Andrea-Lyle Cashion 1 Hazlip, 10-4n-1e, which had oil shows at 6,456-71 ft., and some 2 miles north of Kemp Drilling Co. 1 U. S. A., which had no shows.

In Rankin County, Lion Oil 2 Denkmann, 22-7n-4e, Smackover wildcat, is drilling out cement inside 7-in. casing at 12,965 ft. Lion set casing at 15,090 ft. This wildcat is being closely watched since it is the firm's second attempt in Rankin County on a Smackover test.

In Monroe County, Union Producing Co. has pumped 1,200 bbl. of mud and 100 bbl. of water in 1 Sanders, 22-15s-6e, in an effort to establish circulation. Mud weight was built up to 15 gal. and well shut in over night with a casing pressure of 950 psi. Difficulty has been encountered with lines and blow-out preventer freezing up at this gas discovery.

A new Tuscaloosa wildcat has been staked in Wayne County approximately 3 miles northwest of the town of Clara. Test is G. M. & O. Land Co. and Lyle Cashion Co. 1 U. S. A., 1-7n-8w. Location is approxi-

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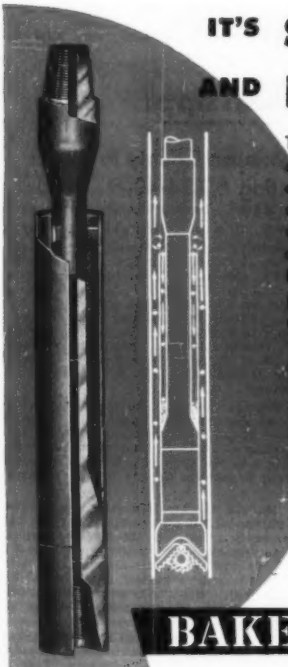

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mately 6 miles northwest of Humble Oil & Refining Co. D-1 G. M. & O. Railroad Co., which logged top of the Eutaw at 5,645 ft., Marine Tuscaloosa at 7,060 ft., and Lower Cretaceous at 7,506 ft.

Another wildcat for the state of Mississippi is Kingwood Oil Co. and Kemp Drilling Co. 1 E. L. Gray, 25-16n-5e, Hinds County. Test will be drilled to 7,200 ft. to explore the Eutaw formation.

Plans are now under way to rework an old well in Monroe County, which is now bottomed at 3,205 ft. Test is W. M. Dalton, and John N. Buie 1 Cole, NE SW 15-15s-17w, which will be drilled to 4,000 ft. to the Hartselle sandstone. This well is located 18 miles east of Union's 1 Sanders, which blew out while operators were cleaning out an old abandoned hole at 2,900 ft.

MISSISSIPPI WILDCAT FAILURES

Adams County: B. Serio Drilling Co. 1 E. H. Butler, 17-5n-2w, dry, TD 6,808 ft.
Lincoln County: Gulf Refining Co. 1 M. Walker Unit, 8-7n-9e, dry, TD 11,195 ft.

FLORIDA WILDCAT FAILURE

Escambia County: Commonwealth Oil Co. 1 M. Lischkoff, 8-2s-31w, dry, TD 7,494 ft.

Eastern Texas

Second Woodbine Venture Slated for Houston County

DALLAS – A second Woodbine exploration has been scheduled for Houston County, 10 miles west of Grapeland. Magnolia Petroleum Co. will drill its 1 J. M. Murray to 6,500 ft.

Location is on a large tract in the Daniel McLean Survey about 2,000 ft. southeast of Morris Coats and Ralph Spence 1 Rialls, completed this year as a sub-Clarksville discovery with pay at 5,764-70 ft., after testing to the Woodbine.

Ralph Spence 1 Daily-Frazier, Samuel Chears Survey, was reported dry this week after drilling to the Woodbine. Total depth was 6,393 ft. Location is about 2 miles east of the above discovery.

In Fannin County Leland Fikes 1 Sarah Brown, Thomas Ragsdale Survey, was reported dry at 4,220 ft. The wildcat was located 2 miles southwest of Bailey.

Also in Fannin County, Hamilton-Powell Drilling Co. 1 Fred Loshe, Robert Kerr Survey, was attracting considerable interest, with no reports confirmed. The well was being drilled tight, and the rig site was fenced in. The wildcat was projected to the deep pays found in the Sandusky area and was said to be drilling below 6,400 ft. Some sources indicated the well had oil shows in a Mississippian sand around 5,000 ft.

Union Oil Co. of California has scheduled a second deep test in the Friendship area 6 miles west of Gladewater in northeast Smith County. The test is to be the 1 J. L. Morrison, located on a 58-acre tract in the S. J. Lott Survey.

Union drilled the 1 Will McGinnis, Lott Survey, to 8,284 ft. It was then taken over by Bobby Manzield for completion from Pettit pay at 8,046-53 ft.

EAST TEXAS (DISTRICTS 5 AND 6) WILDCAT FAILURES

Bowie County: Caddo Oil Co., Inc. 1 International Construction Co., J. S. James Sur., dry, TD 8,715 ft.
Hopkins County: B. F. Phillips 1 Travis Rhodes, L. P. Dikes Sur., dry, TD 7,349 ft.
Leon County: Humble Oil & Refining Co. 1 Jewel Martin, M. LaMarques Sur., dry, TD 9,547 ft.
Marion County: R. W. Fair 1 Mason Gas Unit, J. Bartlett Sur., dry, TD 6,624 ft., Pettit 6,362 ft.

Wood County: Erwin and Felder & Co. 1 W. L. Hulsey, N. Nelson Sur., dry, TD 5,941 ft., sub-Clarksville 4,500 ft.

Texas Gulf Coast

Fayette County Discovery Potentials 85 Bbl. Daily

HOUSTON.—Potential test has been run on Hamman Oil & Refining Co. 1 Frank Weidel et al, oil discovery 4½ miles southwest of Muldoon in Fayette County. From perforations at 2,361-64 ft., the well was completed for 85 bbl. of 23°-gravity oil daily. The well is bottomed at 2,503 ft. with 5½-in. production string at 2,420 ft. Top of the pay was encountered at 2,361 ft. Operator is moving in to drill 2 Weidel et al, and staked location for a third well in the immediate area.

A new oil pool has been opened in Bee County at T. F. Murchison 1 J. A. Hynes, which apparently found a new pay in the Massingill area. From perforations at 5,400½-07 ft. the well flowed 100 bbl. of oil daily based on 15-minute test. Operator is running tubing in the well for completion.

Elsewhere in the county, W. W. Carter has potentialed his new gas-distillate discovery, 1 T. W. Robertson, 2 miles south of Maley field. From Mackhank sand at 8,456-63 ft., the well flowed 41,000,000 cu. ft. of gas daily plus 27 bbl. of distillate per million cubic feet. Tubing pressure registered 2,636 psi. when gaged through 15/64-in. choke.

The third Wilcox pay has been opened in the Gohlke-Fordtran area of DeWitt County at Anderson-Prichard Oil Corp. 1 Albina Bialek, outpost on the southwest flank of the field. On drill-stem test at 8,175-79 ft., after acidizing with 250 gal., the well flowed the 1,000-ft. water cushion in 6 minutes and showed working pressure of 1,575 psi. in 12 hours. Well flowed at the rate of 2,000,000 cu. ft. of gas per day plus 2-2½ bbl. of distillate per hour. Initial bottom-hole flowing pressure was 2,500 psi., and shut-in pressure was 3,400 psi. Operator ran tubing and swabbed, and well flowed and cleaned to pits.

It is reported that Tex-Harvey Oil Co. has suspended operations temporarily on 1 Robert Winkelmann, Washington County wildcat about 4½ miles north of Brenham. A drill-stem test of perforations at 8,707-11 ft. had recovery of 180 ft. of mud and 810 ft. of 33°-gravity oil. However, salt water broke in, and perforations were squeezed in attempt to shut off water. Hole is bottomed at 10,121 ft., with pipe set somewhere near bottom.

American Republics Corp. 17 William Smith fee has been completed in a new pay for Hull field, Liberty County. On potential test, through perforations at 8,995-9,006 ft., the well flowed 207 bbl. of 29°-gravity oil daily through 11/64-in. choke.

TEXAS GULF COAST (DISTRICTS 2 AND 3) SUCCESSFUL WILDCATS

Calhoun County: Gas discovery—Alcoa Mining Co. 172-1 State Lease 35951 in San Antonio Bay, State Tract 172, TD 6,089 ft., perf. 2,856-68 ft., IP 2,280,000 cu. ft. of gas daily; perf. 2,620-39 ft., IP 5,900,000 cu. ft. per day.

DeWitt County: Oil discovery—Deep Rock Oil Corp. 1 A. J. Riesterer, Thos. H. Bell Sur., TD 8,545 ft., perf 8,277-82 ft., IP 81 bbl. oil per day, ¼-in. choke, 32° gravity.

Galveston County: Oil discovery— John W. Mecom 1 San Leon Farms et al, A. Edwards Sur., A-10, TD 10,515 ft., perf. 8,445-60 ft., IP 49 bbl. oil per day, 37.7° gravity.

Liberty County: New pay at Hull—American Republics Corp. 17 William Smith fee, William Smith Sur., TD 9,539 ft., perf. 8,995-9,006 ft., IP 207 bbl. oil per day, 11/64-in. choke, 29° gravity.

Matagorda County: Gas discovery—Brazos Oil & Gas Co. 1 State of Texas "E-B" 35890, State Tract 55, Tres Palacios Bay, TD 4,660 ft., perf. 4,526-38 ft., IP 26,000,000 cu. ft. of gas per day.

Victoria County: Oil discovery—Sunray Oil Corp. 16 J. Pickering, J. W. Black Sur., A-133, TD 7,800 ft., Frio 5,895-98 ft., IP 81 bbl. oil per day, 7/64-in. choke, 36.2° gravity.

TEXAS GULF COAST (DISTRICTS 2 AND 3) WILDCAT FAILURES

Chambers County: R. S. Randerson 1 Middleton et al, Sec. 82, Lot 1, H&TC RR Sur., dry, TD 8,317 ft.

Colorado County: Caroline Hunt Sands 1 L. P. Bunge, N. Whiting & N. Osburn Sur., A-48, dry, TD 6,500 ft.

DeWitt County: H. L. Hunt 1 Korth, S. Best Sur., A-66, dry, TD 8,016 ft.

Kirby Petroleum Co., 1 Kuester Stevens, C. Monod Sur., A-349, dry, TD 8,214 ft.

Hardin County: R. E. Hibbert & M. T. Halbouty 1 Breath Wood et al, Jose Scott Sur., A-499, dry, TD 10,222 ft.

J. P. Owen 1 Doty & Jackson, Lot 21, W. N. Cox League, A-13, dry, TD 7,510 ft.

Harris County: Hankamer Investment Co. 1 G. N. Spencer et al, Thomas Nellis Sur., A-605, dry, TD 7,546 ft.

Jackson County: Union Oil Co. of California 1 John M. Bennett, Ramon Musquez Sur., A-59, dry, TD 9,063 ft.

Jefferson County: U. S. Oil Co. of Texas 1 Texas Rice Land Co., M. Grange Sur., A-26, dry, TD 9,499 ft.

Liberty County: John W. Mecom D-6 A. Merchant Estate, H&TC Sur. 1946, A-767, dry, TD 13,749 ft.

Matagorda County: John W. Mecom 2 J. H.

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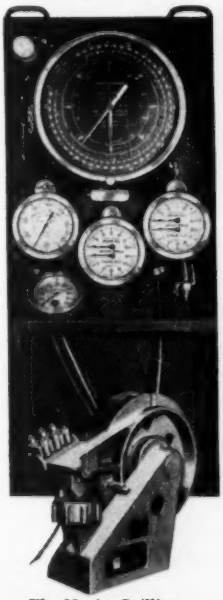

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Craig Estate, T. Williams Sur., A-107, dry, TD 4,844 ft.

Wharton County: Dentler & Dentler 1 Lenora Mitchell et al, Jno. Dinsmore Sur., A-19, dry, TD 6,253 ft.

Southwest Texas

New Oil Pay Established Between Webb County Fields

CORPUS CHRISTI.—New pay has been established half way between Albercas and North Albercas fields, Webb County, at Sid Katz 6 A. M. Bruni Estate. On drill-stem test of perforations at 2,205-10 ft., tool open 1 hour, well recovered 200 ft. of pipe-line oil and 300 ft. of salt water. Albercas field produces from the Cole sand at 2,125-80 ft., North Albercas produces from the Mirando sand at 2,313-21 ft., and the Pettus at 2,520-27 ft.

A new distillate pool has been opened 2½ miles southwest of Robstown, Nueces County, at Gulf Plains Corp. 1 W. B. Mohle. On drill-stem test at 8,001-31 ft., ¼-in. chokes, the well showed gas and distillate with no gage available. Operators are drilling ahead at 8,060 ft.

C. G. Glasscock has set 5½-in. production string in 1 Osca Daskam, wildcat 4 miles northeast of Yturria oil production in Hidalgo County. Operator ran a drill-stem test at 4,427-31 ft. and had recovery of 30 ft. of distillate in 12 minutes. Working pressure was 500 psi.

Same operator's 1 Mellie Esperson Estate, Cameron County wildcat, was dry at 13,726 ft. Casing was set on bottom at 14,137 ft., and perforations were made at 13,694-13,704 and 13,708-26 ft. to test a gas sand picked up by gamma ray log.

Potential test has been run on Newman Bros. and Alaska Steamship Co. 1-G South Texas Syndicate, gas-distillate discovery 2½ miles northeast of Greens Branch field in McMullen County. The well showed good for 22,500,000 cu. ft. of gas per day on open flow. Tubing pressure registered 2,650 psi. Production is from the lower Wilcox at 6,122-32 ft. and 6,158-68 ft. This well was temporarily abandoned at 4,136 ft., and operator went back in, cleaned out, and deepened for completion.

Humble Oil & Refining Co. has recovered oil on drill-stem test at 1 Jones, wildcat in the West Pruitt area of Atascosa County. On test of interval 4,971-89 ft., tool open 20.5 minutes, recovery was 180 ft. of 36.5°-gravity oil with trace of mud. This well is 7,500 ft. west-southwest of Pruitt field and 2 miles northwest of Charlotte field.

In Jim Wells County, Bjarne Rossebo has tested a show of oil and distillate-cut mud at 1 Eva Coopwood. On 7-minute drill-stem test at 5,410-47 ft., ¼-in. chokes, the well developed 410 psi. working pressure and recovery was 30 ft. of oil and distillate-cut mud. Operator set 5½-in. production string on bottom at 5,892 ft.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) SUCCESSFUL WILDCAT

Atascosa County: Oil discovery—J. D. Hedley 1 Chas. Muil, Jorea C. Mattison Sur., A-606, TD 2,768 ft., Carrizo Wilcox 2,668-77 ft., IP 34 bbl. oil per day on pump, 21° gravity.

SOUTHWEST TEXAS (DISTRICTS 1 AND 4) WILDCAT FAILURES

Atascosa County: Chas. Daubert & Walter J. Achning 1 E. E. Wilson, John Gaston Survey 1245, 4 mi. SE of Charlotte, dry, TD 5,515 ft.

Cameron County: C. G. Glasscock 1 Mellie Esperson Estate, Potrero de San Martin Grant, dry, TD 14,157 ft.

Duval County: Edgar Linkenhoger 1 D. C. Chapa, J. H. Gibson Sur. 419, A-665, dry, TD 5,512 ft.

Taylor Refining Co. G-2 E. A. Parr, SA&MG Sur. 6, A-2036, dry, TD 6,000 ft.

Gonzales County: Forney & Winn, Sutton Drilling Co. 1 O. M. Christian Estate, Andrew Winters League, dry, TD 2,470 ft.

Guadalupe County: Pat H. Baker et al 1 Isaac Allen, J. M. Bell Sur., A-75, dry, TD 1,466 ft.

Jim Hogg County: Dulaney Oil Co. et al 1 Merchants State Bank & Trust Co.-Gasoline Production, GB&CNG Sur. 151, dry, TD 1,194 ft.

Jim Hogg County: V. G. Schimel et al 1 Isidro R. Vela, T. R. Davis 573, Ey Peyote Grant, dry, TD 2,062 ft.

Kenedy County: Atlantic Refining Co. 5 McGill Ranch, Santa Rosa de Arriba Grant, A-35, dry, TD 9,000 ft.

McMullen County: Bridwell Oil Co. 3 Mabel Brownson, John Fadden Sur., A-3, dry, TD 905 ft.

Webb County: O. W. Killam 1 Frost National Bank et al Guiterrez Pasture, J. V. Borrego Grant, dry, TD 4,568 ft.

Harry E. Murray et al 1-B Mabel Adami, Sec. 337, 25 mi. NW of Freer, dry, TD 1,710 ft.

Willacy County: Glenn Oil Corp. 1 E. C. Kincade, San Juan de Carricitos Grant, Share 14, dry, TD 8,016 ft.

Williamson County: J. P. Bristow & Co. 2 Safford & Herndon, M. F. DeGraffenreid 109 Sur., dry, TD 1,750 ft.

Zapata County: Chas. E. Long, Sr., et al 2-A Mrs. Smith et al, El Javali Grant, Harvey Subd., dry, TD 1,703 ft.

Zapata County: Pierce-Texita Oil Co. 1 Noyes Smith et al, El Javali Grant, Sec. 1, dry, TD 1,705 ft.

North Central Texas

Nolan County Wildcat Tests Oil in Pennsylvanian Reef

WICHITA FALLS.—Rowan & Hope 1 J. T. Seago, northwest Nolan County wildcat, developed free oil on two drill-stem tests and oil-cut mud on another, all in Pennsylvanian reef.

Top of the reef was reported at 6,085 ft. First test at 6,250-63 developed 150 ft. of clean oil and 50 ft. of salty mud in 1 hour; from 6,264-83 ft. the recovery was 60 ft. of oil and gas-cut mud in 1 hour; and a third test at 6,352-83 ft. had 300 ft. of clean oil, 245 ft. of oil and gas-cut mud and 45 ft. of oil and fresh water-cut drilling mud. At last report the pay section had been shot, and tubing was being run for production tests.

North of Blackwell, General Crude Oil Co. 1 Elmer Jordan, topped the Ellenburger at 6,400 ft. and was to drill-stem test at 6,600 ft.

Seaboard Oil Co. 1-A Billie Hanks, confirmation well and southwest offset to the Hylton-Strawn discovery in southeast Nolan County, was drilling ahead in the lower Pennsylvanian at 5,940 ft. The well indicated production from the Strawn when it flowed oil on a drill-stem test from 5,402-74 ft. A 2-hour test from 5,663-5,779 ft. developed only 50 ft. of slightly gas-cut mud.

Clay County received a deep location at Hassie Hunt Trust 1 D. M. Cobb, in Section 2, J. J. Scott Survey, A-694, 8 miles northwest of Shannon. Proposed depth was 6,000 ft.

In Montague County, Luke Grace Drilling Co. 1 T. H. Milam was scheduled to 5,800 ft. as a wildcat test 2 miles southeast of Ringgold, in Block 54, Abel-Beason Survey.

F. Kirk Johnson 1 Eliza Cox had prospects of extending production 1 mile north of Rusmag field in Jack County. Drill-stem test at 4,859-85 ft. had gas in 15 minutes and recovered 260 ft. of oil.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) SUCCESSFUL WILDCATS

Archer County: W. Frank Knox, Jr. 20 Knox, Sec. 2,433, TE&L Sur., TD 1,438 ft., pay 1,431 ft. IP (?).

Callahan County: W. D. Sorrels 1-A Mitchum, Sec. 3,191, TE&L Sur., TD 4,065 ft., elev. 1,470 ft., pay 4,040 ft., IP pumped 56 bbl. 41°-gravity oil.

Clay County: Armour Properties 1 Burford Scaling, Block 2,696, TE&L Sur., TD 4,640 ft., pay 4,504 ft., IP pumped 217 bbl. 45°-gravity oil.

L. T. Burns 4 H. Sanzenbacher, L. N. Sparks Sur., TD 4,590 ft., pay 4,580 ft., IP 379 bbl. 43°-gravity oil, 10/64-in. choke, TP 25 psi., GOR 360:1.

Jack County: Tom C. Patten Production Co. 1 J. R. Williams, 2-A88-BS&F, TD 4,498 ft., elev. 1,078 ft., conglomerate pay 4,475 ft., IP 350 bbl. 40°-gravity oil, 13/64-in. choke, TP 75 psi., GOR 520:1.

Throckmorton County: American Petroleum Co. 1 T. G. Hendrick, 9-M5-Brooks & Burleson, TD 1,316 ft., pay 1,310 ft., IP 91.5 bbl. 38°-gravity oil.

Lester Miller 2 E. D. Condron, Sec. 1,628, TE&L Sur., TD 1,550 ft., pay 1,540 ft., IP 75 bbl. 38°-gravity oil, 1/16-in. choke, TP 50 psi., GOR 350:1.

Young County: Reno Oil Co. 1 Bishop, Block 1,443, TE&L Sur., TD 5,200 ft., elev. 1,184 ft., pay 3,188 ft., IP 10 bbl. 39°-gravity oil.

NORTH CENTRAL TEXAS (DISTRICTS 9 AND 7-B) WILDCAT FAILURES

Archer County: Weldon Guest 2 J. J. Perkins, Block 134, ATNCL Sur., dry, TD 1,390 ft., Gunsite 1,370 ft.

Moco Oil Co. 1 Bloodworth, M. Cartwright Sur., A-60, dry, TD 1,205 ft., Gunsite 1,156 ft.

Brown County: D. H. Wigner 1 M. E. French, 99-32-R. Mixon Sur., dry, TD 1,150 ft.

Callahan County: H. B. & G. Drilling Co. 1 Russell Hart, Sec. 59, BOA Sur., dry, TD 4,412 ft.

McCarty & Coleman 1 S. E. Edwards, Sec. 15, BBB&C Sur., dry, TD 1,750 ft.

Coleman County: Monty Freedman 1 W. W. Rae, Sec. 309, G. W. Morgan Sur., dry, TD 3,245 ft.

W. H. Hunt 1 W. N. McCulloch, Sec. 488, Bradford Fowler Sur., dry, TD 2,265 ft.

Joe Krchnak 1 Tom Stewardson, J. A. Sylvester Sur., dry, TD 2,662 ft., Caddo 1,860 ft., Ellenburger 2,450 ft.

Cooke County: Baker & Taylor Drilling Co. 1 H. Pels, Geo. Ivey Sur., A-516, dry, TD 3,405 ft., Ellenburger 3,234 ft.

J. J. Lynn 1 P. M. Endres, F. H. Hamilton Sur., A-448, dry, TD 2,660 ft., elev. 935 ft., Ellenburger 2,580 ft.

R. H. Lynn & I. R. McQueen 1 H. G. Perry, A. J. Man Sur., A-733, dry, TD 3,625 ft.

Eastland County: Capital Co. 1 G. E. Woods, 54-4-H&TC, dry, TD 3,737 ft.

Fisher County: Bay Petroleum Corp. 1 W. E. Melton, 115-2-H&TC, dry, TD 6,520 ft.

W. A. Moncrief 1 National Gypsum Co., 290-2-H&TC, dry, TD 6,710 ft., elev. 1,879 ft., Ellenburger 6,555 ft.

Jack County: McMahon & Bullington Drilling Co. 1 Pursley, N. A. Slaughter Sur., dry, TD 3,337 ft.

Star Oil Co. 1 T. C. Counts, W. Williams Sur., A-876, dry, TD 5,378 ft.

W. T. Waggoner Estate 1 Josephine Estate-Givens, W. L. Smith Sur., dry, TD 6,543 ft.

Jones County: Clark & Cowden 1 G. W. Smith, 8-354-Austin & Williams Sur., dry, TD 3,651 ft.

S. C. Herring 1 Jasper Gentry, Sec. 61, BBB&C Sur., dry, TD 3,215 ft.

H. F. Pettingrew 1 W. D. Baker, William Smith Sur. 14, dry, TD 4,140 ft.

Rice & Dobbs 2 Edna Thomas, Sec. 22, HT&B Sur., dry, TD 1,905 ft.

Knox County: Miami Operating Co. 1 B. H. Hunt, Block 8, J. Garner Sur., dry, TD 6,112 ft., Ellenburger 6,000 ft.

Montague County: Engle Petroleum Co. 1 Frank Collier, J. M. Collier Sur., A-489, dry, TD 6,841 ft., elev. 1,250 ft.

Engle Petroleum 1 Yeager Estate, 28-4-H&TC, dry, TD 6,100 ft.

Miami Operating Co. 1 R. L. Hancock, ETRR Sur., A-248, dry, TD 5,838 ft.

Paul C. Teas 1 Godwin, W. E. Crawford Sur., dry, TD 3,000 ft.

Nolan County: D & E Co. 1 Joe Larry, 194-64-H&TC, dry, TD 5,686 ft.

Shackelford County: B. W. Fitzgerald 1

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F. Kirk Johnson 1 B. G. Chaney, B. J. McGaha Sur., dry, TD 4,500 ft., elev. 1,107 ft., Caddo 3,350 ft., Bend 3,808 ft., Mississippian 4,376 ft., Ellenburger 4,458 ft.

Stonewall County: J. W. King 1 Minor Alexander, 24-F-H&TC, dry, TD 6,883 ft., elev. 1,775 ft., Flippen 3,115 ft., Ellenburger 6,320 ft.

Taylor County: Texas Crude Oil Co. 1-14 Toombs, 14-9-SPRR, dry, TD 3,803 ft., elev. 1,918 ft., Flippen 2,855 ft.

S. B. Robert and Eastland Co. 1 Bone, 15-18-T&P, dry, TD 3,213 ft.

Wilbarger County: Davon Oil Corp. 1 Bingham, 15-11-H&TC, dry, TD 5,422 ft., elev. 1,367 ft., Wichita Albany 1,580 ft., Coleman Junction 2,150 ft.

Wise County: F. A. Gillespie & Sons Co. 1 W. M. Simpson, Block 5, Hill Sur., dry, TD 5,556 ft., Caddo conglomerate 4,590 ft.

Young County: Neeld & Hood 1 Eugenia Taylor, W. C. Blakely Sur., dry, TD 3,521 ft.

Kansas

Second Pool Indicated For Decatur County

CONTINENTAL OIL CO. is ready to start production tests of promising oil showings obtained in the Lansing lime section at its 1 Gillespie, NE SE NE 34-5-27, southeastern Decatur County wildcat. Successful completion of the well will open the country's second pool.

Pay zone was topped at 3,631 ft. (—967 ft.). A 60-minute drill-stem test was made of an interval at 3,662-78 ft., in which the well flowed gas in 28 minutes and filled 3,392 ft. of oil with a bottom-hole pressure of 1,160 psi. Since then, the hole has been deepened to 4,077 ft. in granite wash, topped at 4,032 ft. Casing was run through the Lansing section to 3,891 ft.

Location of the well is 3 miles southwest of the county's only other production, the Jennings pool, opened last September by The Texas Co. It is about 1½ miles north of the Sheridan County line and about 2½ miles northwest of the Adell pool, across the line in the latter county.

Discovery well of the Jennings pool and its west offset also produce from the Lansing, which was topped in the discovery well at 3,407 ft. (—908 ft.). Two additional wells, one a northwest diagonal offset and the other a north offset, have just been completed in a shallower pay zone, the Howard limestone of the Wabaunsee group (upper Pennsylvanian). One (1 Munson, SE SE NW 25-4-27) pumped 157 bbl. of oil daily from casing perforations at 3,156-62 ft. The other (2 Munson, SW SW NE 25-4-27) pumped 122 bbl. daily with casing perforated at 3,158-86 ft. Both found water in the Lansing.

Decatur County is located on the state's northernmost tier of counties on the west flank of the Central Kansas Uplift.

Stanolind Oil & Gas Co. has uncovered a prospective new producing area in the northwestern corner of Stafford County where its 1 Taylor, NE NE NW 15-21-14, has promising showings in both the Simpson and Arbuckle zones. Top of the Simpson was logged at 3,648 ft. (—1,717 ft.). A 45-minute drill-stem test at 3,682-96 ft. got 600 ft. of oil with bottom-hole pressure of 820 psi. Arbuckle was topped at 3,707 ft. (—1,776 ft.). A 60-minute drill-stem test at 3,706-12 ft. (total depth) yielded 50 ft. of oil-cut mud. Casing was run 1 ft. in the Arbuckle. Location is 1 mile northeast of the Bayer pool and 1½ miles northwest of the McGinty pool.

Imperial Petroleum Co. appears to be succeeding in making a well at its 1 Vance, SW SW NW 19-11-20, 1 mile north of the Nicholson pool, in northwestern Ellis County. Following a 500-gal. acid application of

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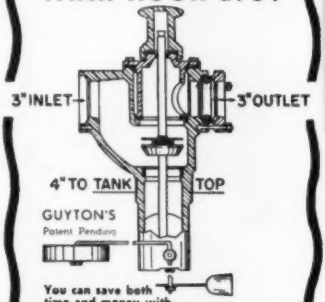

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its Lansing-Kansas City pay, opposite which casing is perforated at 3,712-16 ft., the well swabbed at an average rate of 20 bbl. of oil per hour. The well previously tested water in Arbuckle lime, topped at 3,831 ft. (—1,596 ft.) and drilled to 3,844 ft. Top of the Lansing is 3,521 ft. (—1,286 ft.). The well is a location from the Trego County line.

KANSAS SUCCESSFUL WILDCATS

Cowley County: Crest Drilling Co. and National Refining Cooperative Assn. 1 Morgan, CNL SW NW 22-34s-3e, pumped 35 bbl. oil at 3,281-3,302 ft., TD 3,302 ft.

Graham County: I. Siegel and Prime Drilling Co. 1 Minium, SW SW NW 1-9s-25w, pumped 1,070 bbl. oil at 4,013-17 ft., TD 4,058 ft.

Stafford County: Petroleum Inc. 1 Newcomb "B," SE SE NW 5-21s-13w, pumped 75 bbl. oil at 3,612-15 ft., TD 3,629 ft.

KANSAS WILDCAT FAILURES

Barton County: Imperial Petroleum Co. 1 Huslig, NW NW NE 19-17s-11w, dry, TD 3,386 ft.

Butler County: National Associated Petroleum Co. 1 Webb, NE NE NW 11-26s-6e, dry, TD 3,299 ft.

Edwards County: Phillips 1 Newson "A," SW SW SW 13-26s-17w, dry, TD 4,960 ft.

Ellis County: Aylward 1 Holy Cross, NE NE NW 9-12s-18w, dry, TD 3,693 ft.
Grant Oil Co. 1 Foster, NE NE NW 1-15s-16w, dry, TD 3,474 ft.

Graham County: Glickman 1 Ferland, NE NE SW 23-8s-21w, dry, TD 3,667 ft.
M. B. Armer 1 Noah, NW NW SE 21-10s-21w, dry, TD 3,855 ft.

Hodgeman County: Kingwood 1 Bamberger, NW NE NW 27-21s-23w, dry, TD 5,006 ft.

Pottawatomie County: H. E. Sloan 1 Brown, SW SW NW 34-9s-12e, dry, TD 3,350 ft.

Reno County: Texas-Atlantic-Gulf-Sunray-Skelly 1 E. Foss, NE NE SE 27-26s-8w, dry, TD 4,458 ft.
Pabco 1 Sung, SE SE NE 23-26s-10w, dry, TD 4,432 ft.

Rooks County: Murfin and M. Sitrin 1 Malin, NW NW SW 11-10s-18w, dry, TD 3,780 ft.

Saline County: E. K. Carey and Grant 1 Linn, SW SW NW 28-14s-4w, dry, TD 3,865 ft.
N. Chapro 1 Karber, SW SE SW 28-16s-1w, dry, TD 3,332 ft.

Sheridan County: Peel & Hardman, NW NW NW 2-8s-26w, dry, TD 4,291 ft.

Stafford County: Jackson 1 Ward, NW NW SE 32-23s-14w, dry, TD 4,119 ft.

Trego County: Vickers 1 Baugher, NW NW NE 26-11s-21w, dry, TD 3,935 ft.
Strain 1 Hamburg, SW SW SW 8-12s-21w, dry, TD 4,030 ft.

Oklahoma

Beaver Discovery Well To Be Placed on Pump

FLYNN OIL CO. is setting pumping equipment and making connections to complete its 1 School Land, SE SE SE 35-5n-23eCM, rank wildcat discovery well north of Beaver, in Beaver County, Oklahoma Panhandle. Previously reported as swabbing 20 bbl. of oil per hour with production later being gaged at 8½ bbl. per hour, making considerable mud, the well since then has been cleaned with an application of 250 gal. of mud acid. It then swabbed at the rate of 1½ bbl. of oil per hour. After tubing was run, it flowed for 5 hours, making 100 bbl. before dying. The well is being completed at its previously reported total depth of 5,549 ft. in a soft, porous lime formation, open below 5,540 ft.

Twelve miles to the northwest, in the Light Ranch gas-condensate field, the only other productive area in Beaver County, J. M. Huber Corp. is completing its 1-B Light, C SW SE 16-6n21ecM, as a ¾-mile extension and new-pay discovery for the field. Testing after perforating casing at 6,128-45 ft. and 6,162-82 ft. Morrow zone sand, not the regular pay of the field, the well flowed an estimated 1,500,000 cu. ft. of gas per day. The well previously tested perforations at 6,265-71 ft. and 6,313-23 ft. in the Chester lime (Mississippian), getting a gas flow estimated at 396,000 cu. ft. per day. Location of the well is west of production at the south end of the field, which already extends several miles north into Seward County, Kansas.

Davon Oil Corp. has opened a new pay zone, the Marshall sand, in the East Crescent area of Logan County, where its 1 Crawford, NW SE SE 10-17n-3w, flowed 51 bbl. of oil in 13 hours with casing perforated opposite a saturated interval at 6,130-48 ft. Total depth is 6,204 ft. The well is two locations north of the area's Layton sand discovery well, Davon Oil Corp. 1 Derr, NW NE NE 15-17n-3w, completed earlier this year.

H. Waggoner & Co. is completing its 1 Adams, NE SW SW 15-14n-4e, new Wilcox sand discovery well south of Chandler, Lincoln County. The well pumped and flowed 210 bbl. on a 24-hour completion gage. Total depth is 5,055 ft. with top of the pay at 5,045 ft.

Some oil and gas showings have been encountered by another rank wildcat in Harper County, northwestern Oklahoma, but are being passed up for the time being. The wildcat is Deep Rock Oil Corp. 1 Lamunyon, C NE NW 21-28n-24w, 5 miles north of Deby Springs and 9 miles northwest of Buffalo, in the northwestern part of the county. Showings were in the St. Genevieve, topped at 6,534 ft. (—4,418 ft.). A 90-minute drill-stem test at 6,536-50 ft. recovered 30 ft. of oil and gas-cut mud. The well logged Marmaton at 5,626 ft. and Chester lime at 6,260 ft.

Confirmation of the recent discovery of Misener sand oil production in the Southwest Gilcrease gas area of Hughes County is indicated in a drill-stem test of the

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pay zone at Beach & Talbot and Darby-Bothwell 1 Leslie Rogers, SE SE NW 24-9n-8e, west offset to the discovery well (Davidor & Davidor 1 Leslie Rogers). The confirmation well topped Misener at 3,992 ft. and logged it to 4,003 ft., where a 2-hour drill-stem test was made, getting 390 ft. of clean oil and 1,140 ft. of muddy oil. Flowing pressure was 475 psi. Hole is being deepened for a look at the Wilcox.

OKLAHOMA SUCCESSFUL WILDCAT

Payne County: Arthur Silberman 1 T. L. Lathrop, SW SW SE 11-17n-4w, pumped and flowed 30 bbl. 39.8°-gravity oil from Misener at 4,102-08 ft., TD 4,269 ft.

OKLAHOMA WILDCAT FAILURES

Comanche County: S. F. Hutcheson 1 M. P. Dunlap, SW NE NE 20-1s-11w, dry, TD 2,498 ft.

Greer County: O. C. Freeman 3 Freeman-Graham, NE NE SE 31-7n-24w, dry, TD 1,919 ft.

Jefferson County: Bar-J Oil Co. 1 Featherstone, SE SE SE 22-3s-5w, dry, TD 2,170 ft.

Kiowa County: J. G. Brown 1 Richardson, SE SE SE 12-5n-20w, dry, TD 450 ft.

Lincoln County: David Warsaski 1 Williams, SW SW NW 4-14n-2e, dry, TD 5,331 ft.
C. P. Barton 1 J. W. Anderson, NW SW NE 5-16n-3e, dry, TD 4,896 ft.

McClain County: Magnolia Petroleum Co. 1 Joe Pritchett, C NE NW 26-5n-3w, dry, 7,721 ft.

Oklahoma County: Harper-Turner and Midstates Pipe 1 Robberson, SE SE NW 36-14n-2w, dry, TD 6,190 ft.

Washita County: Saltmount Oil Co. 1 Willard, C NE SE 15-8n-20w, dry, TD 6,615 ft.

Appalachian-Ohio

Pendleton County Wildcat Staked in West Virginia

PITTSBURGH.—In Union district, Pendleton County, West Virginia, Seneca Oil & Gas Co. of Uniontown, Pa., has located 1 Neil Harper, wildcat, elevation 2,248 ft.

In Holly district, Webster County, United Fuel Gas Co.'s wildcat, 6761 Henry A. Brockerhoff, elevation 1,420 ft., completed for 1,852,000 cu. ft. gas from Maxon sand at 1,6[illegible] ft. Gas was logged at 1,065-93 ft., [illegible] at 1,145-1,318 ft., and total depth w[illegible]5 ft.

[illegible]n district, Preston County, Hope [illegible] Gas Co. located 9699 D. C. Bishoff for a deep test on elevation of 1,892 ft.

In Center district, Gilmer County, Earl Goodwin 1 J. W. Smith et al made 1,225,000 cu. ft. of gas from Maxon sand at total depth of 1,789 ft.

In Garrett County, Maryland, Columbian Carbon Co. completed 1 Artie E. Dodge, gaging 50,000 cu. ft. gas from Oriskany sand at 4,227 ft. The well logged chert at 4,108 ft. Total depth was 4,395 ft.

Clarksburg Gas Co. 1 T. W. Ashby completed for 37,000 cu. ft. of gas. Chert was logged at 3,531 ft., Oriskany sand at 3,640 ft., gas at 3,661-3,664 tnd 3,719 ft. Total depth was 3,719 ft.

Fox & Trimble 2 McGee, elevation 2,407 ft., recorded the chert at 3,857 ft. and is drilling at 3,859 ft. The Onondaga was logged at 3,823 ft., and the casing was set at 3,770 ft.

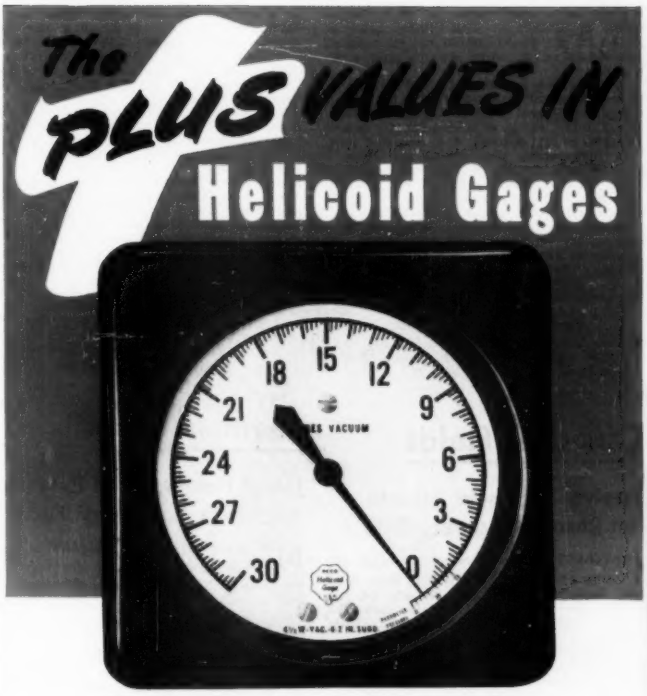
MARYLAND SUCCESSFUL WILDCATS

Garrett County: Columbian Carbon Co. 1 Artie E. Dadge, IP 50,000 cu. ft. gas, chert 4,108 ft., Oriskany sand 4,227 ft., TD 4,395 ft.

Clarksburg Gas Co. 1 T. W. Ashby, IP 37,-000 cu. ft. gas, chert 3,531 ft., Oriskany sand 3,640 ft., gas 3,661-3,664 and 3,719 ft., TD 3,719 ft.

OHIO

Ohio Fuel moved ¾ mile west of field in Pleasant Township, Perry County, and



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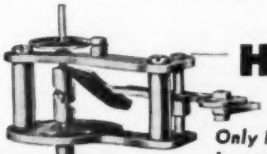

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brought in a small gasser at its 1 Bertha Lewis in Section 29. The Clinton sand, at 3,695-3,736 ft., gaged 200,000 cu. ft. natural, and 350,000 cu. ft. when shut in after a 60-qt. shot.

In the same township, Ohio Fuel moved ½ mile west of the field in Section 5 and completed a nice well at 1 Carrie Brown. The Clinton sand, at 3,702-3,737 ft., gaged 1,400,000 cu. ft. natural, and was not shot.

In Bladensburg pool, Shuff and Bucy 2 C. C. Harris, Section 6, Jackson Township, Knox County, showed for 12 bbl. natural and 167 bbl. in 24 hours after shot. The Clinton sand was logged at 2,760-2,794 ft.

Status Development Co. extended field ½ mile to the north and east with its 1 Paul Morehead, Seetion 26, Pike Township, Stark County. The lower Clinton sand, at 4,764-81 ft., gaged 780,000 cu. ft. natural with 1,200 psi. pressure.

OHIO WILDCAT FAILURES

Medina County, Chatham Township: Ohio Fuel Gas Co. 1 Chas. E. Young, Lot 1, Clinton, no sand, TD 3,103 ft.

Canadian Fields

Twelve Strikes in Alberta Set Record Discovery Rate

CALGARY.—Discoveries of oil and gas were being made at a rate of more than one every two days in western Canada during the first 3 weeks of December, a record rate for Canada's petroleum industry.

Twelve of the strikes made during this 21-day period were in Alberta, while Manitoba accounted for the other discovery—an oil find in the southwest sector of the province.

Six Alberta wells discovered oil, in the Drumheller, Skaro, East Edmonton, Coutts, East Campbell, and South Calmar areas, while a venture in the Bonnie Glen area struck a sizable flow of gas-distillate during that period. A wildcat in the Chancellor area discovered natural gas plus some naphtha, while four other exploratory ventures struck natural gas, at Hairy Hill, Sullivan Creek, Wavy Lake, and Hanna.

The Manitoba discovery was made in the Linklater area of the Williston basin, about 15 miles south-southwest of the Virden area oil wells and 9 miles east of the Saskatchewan line. The discovery was made by California Standard Co. at its Linklater wildcat, in LSD 2, 21-7-28w1, 60 miles southwest of Brandon. Drill-stem tests at 2,714-58 ft. gave up fluid consisting of about equal parts of oil and water, with a flow rate of around ½ bbl. hourly being established during latest drill-stem test reported.

The Drumheller oil discovery was made by Highbury Syndicate. This wildcat strike was made in the D2 zone of Devonian at a venture located around 70 miles northeast of Calgary, on a six-section farmout from Socony-Vacuum Exploration Co.

The discovery well, Alberta Pacific Consolidated Oils-Socony-Warner 1 Drumheller, in LSD 4, 10-29-18w4, is 8½ miles southeast of previous Drumheller D2 oil production. The well indicated about 20 ft. of D2 pay zone above water, with around 12 ft. of that being porous. Hole was carried down as a test of D3, but is currently being plugged back for D2 production tests.

In the Skaro area of central Alberta, about 40 miles northeast of Edmonton and 6 miles east of Redwater field, the team of Mid-Continent Oil & Gas Co., Ltd., and Clear Petroleums, Ltd., discovered oil in the fragmental limestone. This discovery, Mid-Continent and Clear 1 Skaro, in LSD 16, 29-57-19w4, was made below 3,600 ft. Two drill-stem tests, each 2 hours in duration, gave oil recoveries of 1,280 ft. and 1,800 ft., according to company engineers. Crew was preparing to place the well on production tests at last reports.

Chamberlain Oil & Gas, Ltd., struck oil at a venture located a few miles east of Edmonton. The oil was found in the basal quartz sands between 3,700 and 3,728 ft., with drill-stem test in that section giving up 1,300 ft. of light oil. The discovery well, 1 Chamberlain, LSD 10, 32-52-23w4, was being deepened at last report.

The southern Alberta oil strike at Coutts is in an area where exploratory operations have increased considerably during the past few months. The encouraging oil show was obtained at a venture being drilled by the team of Rio Tinto Alberta Oils, Ltd., and Punch Petroleums, Ltd. The well, Rio Tinto and Punch 1 Red Coulee, LSD 10, 6-1-16w4, 7 miles west of Coutts and 55 miles southeast of Lethbridge, gave up 120 ft. of gassified, light oil. Further production tests will be necessary to obtain the commercial prospects for this venture.

The East Campbell gas and oil strike was made by the Alberta team of Decalta Oils, Ltd., and Halcro Oils, Ltd. The find was made in the Cretaceous at the team's well in LSD 1, 30-54-24w4, 2 miles southeast of

(Continued on page 129)

Permian Basin

Good Flowing Well Extends Pembrook Spraberry Field

MIDLAND.—The rapidly expanding Pembrook Spraberry field of northeast Upton County received a 1-mile northwest extension and a good flowing well, at Sohio Petroleum Co. 5 E. D. Bernstein, NW NW 5-N-HE&WT. Completion was for 394 bbl. of 38°-gravity oil a day through ½-in. choke from open hole at 7,194-7,305 ft., total depth. On elevation of 2,746 ft. top of pay was placed at 7,225 ft. Stratafrac treatment was used on the section.

Week's developments gave the new Elkhorn-Ellenburger field of northeast Crockett County its fourth producer and ½-mile southwest extension plus a ½-mile north extension prospect.

On the southwest was Continental Oil Co. 4-A Shannon in 22-UV-GC&SF which completed for 300 bbl. of 40°-gravity oil a day through 26/64-in. choke from 5 ft. of pay at 7,415 ft. The well checked 472 ft. low, structurally, to the discovery. Top of the Ellenburger in the 4-A was around 7,420 ft. with elevation of 2,689 ft.

On the north, Continental 8-A Shannon undoaded oil following a drill-stem test at 7,122-75 ft. Recovery of oil was not reported. It was said to be 9 ft. high to the discovery and at last report was waiting on cement with pipe at 7,141 ft.

Southeast of production, Continental 6-A Shannon reported free oil on a drill-stem test from 7,087-7,185 ft. Recovery was 442 ft. of oil plus 600 ft. of oil and gas-cut mud. A second test at 7,167-7,235 ft. developed 3,540 ft. of free oil and 160 ft. of oil-cut mud.

In Andrews County Phillips Petroleum Co. completed its 1-DD University as a Devonian discovery. The well flowed 488.38 bbl. of oil in 8 hours through ½-in. choke and was given a daily potential of 1,465 bbl. Production was without acid, from perforations at 8,230-8,302 ft. Nearest Devonian production is in the Three Bar field, 1½ miles northwest.

WEST TEXAS (DISTRICTS 8 AND 7-C) SUCCESSFUL WILDCATS

Andrews County: Humble Oil & Refining 1-O University, 20-1-University, TD 11,957 ft., elev. 3,143 ft., Clear Fork 6,815 ft., pay 7,082 ft., IP pumped 18 bbl. 32°-gravity oil.

Crane County: Placid Oil Co. et al 1 A. R. Eppenauer, 14-6-H&TC, TD 5,395 ft., elev. 2,379 ft., Devonian 5,130 ft., pay 5,205 ft., IP pumped 40 bbl. 40°-gravity oil.

Gaines County: E. C. Hitchcock & Son 1 P. S. Dunbar, 25-A12, PSL, TD 4,378 ft., elev. 3,552 ft., San Andres 4,295 ft., IP 15 bbl. 31°-gravity oil, ¼-in. choke, TP 75 psi., GOR 1,800:1.

WEST TEXAS (DISTRICTS 8 AND 7-C) WILDCAT FAILURES

Borden County: Brinkerhoff Drilling Co. 1 Clayton & Johnson, 37-32-T4N-T&P, dry, TD 8,106 ft., elev. 2,444 ft., Spraberry 5,680 ft., Dean 7,040 ft., reef 8,044 ft.

Coke County: Los Nietos Oil Co. 2 H. G. Wendland, Sec. 22, Gutierriz Sur., dry, TD 5,500 ft.

Sun Oil Co. 1-A Central National Bank, S. M. Conner Sur., dry, TD 7,138 ft.

Dawson County: R. B. and W. A. Moncrief, Jr. 1 Cobden, 92-M-EL&RR, dry, TD 8,750 ft., elev. 3,201 ft., Spraberry 7,496 ft., Wolfcamp 8,600 ft.

Gaines County: Union Oil Co. of California 3 T. C. Weltmer, 16-A12-PSL, dry, TD 7,799 ft., elev. 3,558 ft., San Andres 4,380 ft., Clear Fork, 6,125 ft.

Jeff Davis County: Stanolind Oil & Gas Co. 1-A McCutcheon, 16-55-T&P, dry, TD 11,625 ft., elev. 4,822 ft., Delaware lime 5,720 ft., sand 5,790 ft., Leonard 7,350 ft., Montoya 9,760 ft., Ellenburger 11,550 ft.

Kimble County: Superior Oil Co. 1-706, N. J. Nethery, B. Shaw Sur. 706, dry, TD 1,826 ft.

Midland County: Moore Exploration Co. 1 Dowlen-Houpt, 24-39-T2S-T&P, dry, TD 12,982 ft., elev. 2,790 ft., Spraberry 7,760 ft., Pennsylvanian 10,500 ft., Devonian 11,842 ft., Simpson 12,670 ft., Ellenburger 12,902 ft.

Pecos County: Murphy Corp. 1 W. H. Gilmore, 2-3-H&TC, dry, TD 5,316 ft., Devonian 5,063 ft., Fusselman 5,290 ft.

Runnels County: W. S. Day 1 A. S. Dickerson, 364-A393-C, Osgood Sur., dry, TD 4,075 ft.

W. A. Moncrief 1 W. Wilson, R. M. Williamson Sur., dry, TD 2,861 ft.

Schleicher County: Gray Wolfe Co. 1 A. P. Groebl, 5-M-GH&SA, dry, TD 6,012 ft., elev. 2,386 ft., Strawn 5,752 ft.

Terry County: Stanolind Oil & Gas Co. 1 C. L. Anderson, 120-T-D&W, dry, TD 13,136 ft., elev. 3,275 ft., Spraberry 7,590 ft., Wolfcamp 9,280 ft., reef 10,016 ft., Devonian 12,325 ft., Ellenburger 12,780 ft.

Tom Green County: Owenwood Pool 1 M. Herring, 22-A-H&GN, dry, TD 5,307 ft., elev. 2,417 ft., Strawn 5,014 ft.

Yoakum County: Hanley Co. 1 Dorton Estate, 310-D-J. H. Gibson Sur., dry, TD 12,700 ft., elev. 3,715 ft., Clear Fork 6,703 ft., Bend 11,220 ft., Mississippian 11,697 ft., Woodford 12,365 ft., Devonian 12,443 ft.

TEXAS PANHANDLE (DISTRICT 10)

AMARILLO.—Status of a new well completed for oil in Hugoton gas field of Sherman County is presently undetermined as a result of production failure. A 20-bbl. per day oil well, the Kerr-McGee 10 Lee, is now said to be producing gas from Permian buff dolomite where oil production at first was obtained.

The Lee is the first well to be completed for oil in the gas field, though good oil shows are not uncommon in the area. No oil shows were logged on the test, but an estimated 120,000 cu. ft. flowed from gas shows in the formation from 3,110-60 ft. Not until 6,000 gal. of acid had been applied in three stages did the well start making oily fluid at an approximate rate of 50 gal. per hour. After being put on pump, a production high of 57 bbl. of oil and 25 bbl. of water was obtained on 24-hour test.

Lease on which the well was drilled was a farmout to Kerr-McGee from Phillips, with Phillips retaining the oil rights. When the well started making oil the lease was returned to Phillips. It is understood now that the well has again been turned over to Kerr-McGee for tiein to a gas-gathering system.

An 8,750-ft. wildcat location for Ochiltree County has been announced by The Texas Co. 2 miles north of its B-1 McGarraugh wildcat which produced 264 bbl. of oil per day from Atoka. Location of the 1 Swink is in Section 121, Block 13, T&NO Survey, 4 miles northwest of Lips field.

In Gray County, Phillips 1 Johnson "T,"

The Drilling Contractor's Superintendent

Nearly 90% of the 44,000 wells to be completed this year, will be drilled by Drilling Contractors. Consider the problems to be solved, the complexities to be faced, and the responsibilities involved in so huge a schedule of operations, and you will gain some idea of the importance of the Contractor's chief field officer . . . the Drilling Superintendent.

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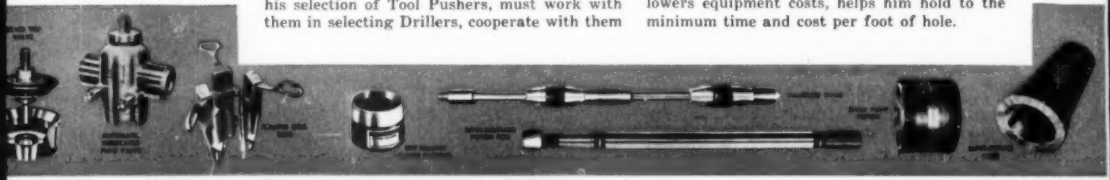

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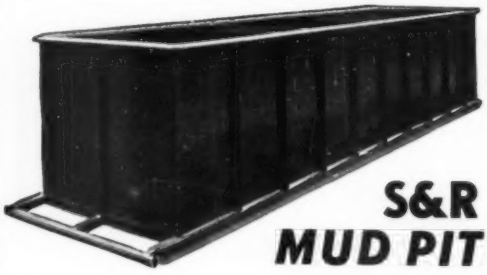

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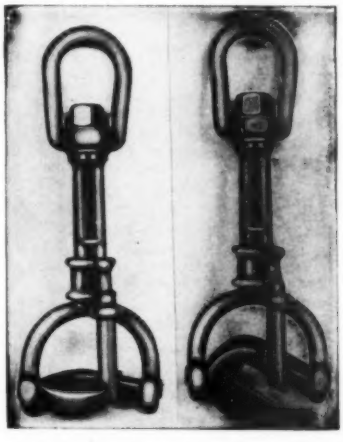

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stepout to oil and gas production in the new Wheat area of Panhandle field, is showing definite signs of making a commercial gas well. Present depth is 2,650 ft. in buff dolomite, where 2,720,000 cu. ft. of gas is accompanying drilling operations.

A Collingsworth County wildcat, reported to have had fluorescence and oil odor in samples from 2,810-2,960 ft., has reached a total depth of 5,516 ft. in granite wash and has been shut down. Laan-Tex Oil Co. may move in cable tools on its 1 Bailey to test prospective formations.

On Standard Oil Co. of Texas 1 Bush, Potter County wildcat, fair fluorescence and a show of oil was recovered in samples from 4,365-80 ft. However, a 2-hour drill-stem test taken from 4,305-80 ft. recovered only 1,440 ft. of salt water, and drilling has been resumed. Projected depth of the test, located 7 miles northwest of the helium-bearing Bush dome, is 7,500 ft. of granite.

Standard Oil Co. of Texas 1 Owens, wildcat in Briscoe County reached total depth at 8,393 ft. in granite wash with no shows.

SOUTHEASTERN NEW MEXICO

Magnolia Petroleum Co. 1 Pope, north extension to the Denton field in 35-14s-37e, completed this week for a daily gage of 486 bbl. of 45°-gravity oil through 24/64-in. tubing choke. Flowing pressure was around 300 psi. and gas-oil ratio was 936 cu. ft. The new well is nearly 2 miles north of present production.

Tide Water Associated Oil Co. 1 Dora Myers, third test in the East Loving Pennsylvanian field, plugged back from that formation and had possibilities of completing in the Clear Fork. At last report the well had washed perforations at 6,335-70 ft. and was swabbing around 7 bbl. of oil an hour. Location is 2½ miles east of Skelly Oil Co. 9-O State. Clear Fork discovery in San Andreas area.

Amerada Petroleum Corp. 1 Fred Turner, 17-20s-38e, reported flowing oil on a drill-stem test from 8,935-9,105 ft. Oil reached the surface in 1 hour and 20 minutes and in 4 hours had tanked 226 bbl. of 45°-gravity oil through ⅝-in. choke.

(Continued on page 129)

Louisiana-Arkansas

Final Travis Peak Pay Discovery at Shreveport

SHREVEPORT.—Completion was reported last week for the new Travis Peak sand gas pay discovery in the old Shreveport field of Caddo Parish, northwestern Louisiana. The new pay discovery well is Houston Oil Co. of Texas ,11 Ellerbe, 1,990 ft. from the south line and 1,997 ft. from the east line of 27-18n-14w.

Initial potential was 12,000 M.c.f. of gas per day, by calculated open-flow method. The flow was accompanied by 25 bbl. of fluid per million cubic feet of gas of which 83 per cent is basic sediment and water. Production is through casing perforations from 6,222 to 6,238 ft. Original total depth was 9,091 ft. Pipe is cemented at 8,695 ft.

DeSoto Parish gained a new Rodessa gas-condensate discovery in the Longstreet area last week. Mid-Century Oil & Gas Co. 1 Williams et al, 600 ft. from the north line and 760 ft. from the east line of 7-13n-15w, is the new discovery. The well has a calculated open flow of 13,500 M.c.f. per day which is accompanied by condensate estimated at 5 bbl. per million cubic feet.

Production is through casing perforations from 5,360-68 ft. in the Gloyd zone of the Rodessa series. The well was drilled to a total depth of 5,378 ft., and a string of 5½-in. pipe cemented on bottom.

Arkansas.—Union County, south-central Arkansas, received a new shallow gas pay—the basal Sligo—the past week. Murphy Corp. 1 Sallie, C SW SW NW 34-18s-14w, conducted a 15-minute drill-stem test at 3,429-35 ft. Recovery in drill pipe was the water cushion cut with gas and 30 ft. of rathole mud cut with gas and oil; there was no formation water showing.

Operators are drilling ahead towards the Travis Peak oil horizon recorded recently at the west offset, same interests' A-1 Robertson, SE NE 33-18s-14w, which was completed in September 1951 pumping 18 bbl. of oil and 15 bbl. of water per day from Travis Peak perforations at 3,620-26 ft.

LOUISIANA WILDCAT FAILURES

Concordia Parish: Caito Oil Co. 1 Eola Corp., NW NW 6-8n-9e, dry, TD 6,513 ft.

Grant Parish: C. E. Simmons et al., 1 Capps-Grisham, 2,490 ft. S and 150 ft. E of NWc 2-9n-1w, dry, TD 1,590 ft.

Caldwell Parish: Natural Gas & Oil Co. 7 Urania Lumber Co., 2,400 ft. S and 1,548 ft. E NWc 9-11n-2e, dry, TD 3,521 ft.

De Soto Parish: Caddo Oil Co. 1 White, 990 ft. N and W SEc 12-12n-13w, dry, TD 3,501 ft.

Tensas Parish: Petersen Drilling Co. 1 Desha Lumber Co., C SW NE 10-13n-10e, dry, TD 7,508 ft.

Madison Parish: Gulf Refining Co. 3 J. W. Carpenter et al., 767 ft. N and 2,986 ft. W NEc Section 35 in 33-16n-14e, dry, TD 2,610 ft.

East Carroll Parish: Sidney Frohman 1 J. M. Hamley estate, 289 ft. N and 1,993 ft. W SEc 2-21n-12e, dry, TD 3,514 ft.

ARKANSAS WILDCAT FAILURES

Lafayette County: Atlantic Refining Co. 1 C. W. Mulkey, C SW NE 21-17s-25w, dry, TD 3,200 ft.

Union County: Lawton Oil Corp. 2 U.S.M. "B," 380 ft. S and 330 ft. W of NEc SW SW 35-18s-14w, dry, TD 4,415 ft.

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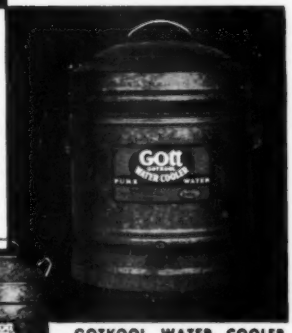

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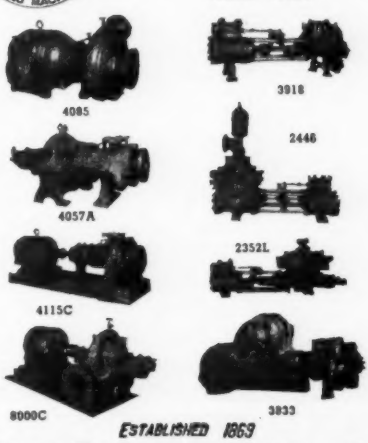

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Central Area

ILLINOIS

A new Devonian producing area has been opened in Christian County where The Texas Co. has completed its 1 Kemmerer Orphanage, SE NW SW 14-12n-1e, on the pump making 35 bbl. net oil per day. Pay zone is at 2,622-38 ft. with bottom of the hole at 2,720 ft.

Location of the discovery is about 2 miles south of the town of Assumption. Nearest production is the Pana pool, opened last May, about 3 miles to the south. Production is from the Bethel sand. It is 5 miles southeast of the Assumption North pool, where important production has been developed in the Devonian, one of three pay zones in the pool.

George & Wrather Drilling Co. and Sam Lewis have completed their 1 Dwight McGrew, NE NE SW 21-2n-6e, northern Wayne County, as the discovery well of a new Rosiclare and McClosky pool. As a dual-zone producer, the well pumped more than 250 bbl. per day initially. Rosiclare pay is at 3,083-89 ft. and McClosky at 3,137-40 ft. The new pool, located 5 miles southwest of Flora, already has been confirmed with a McClosky producer, 1-B McGrew, SW SW NE 21, a location northeast of No. 1, which is being put on the pump after swabbing at the rate of 18 bbl. of oil per hour with pay at 3,143-48 ft. The third well, 3-B McGrew, a location northeast of 1-B, is showing for production with good saturation in both the Rosiclare and McClosky zones, the former logged at 3,078-3,100 ft., and the latter at 3,130-51 ft. Magnolia Petroleum Co. 1 Cook, SW NW SE 21, southeast offset to the discovery well, got a good oil flow in a drill-stem test in the Rosiclare zone at 3,090-3,103 ft., and, at latest report, was deepening to the McClosky.

The new pool opened early in December by George & Wrather Drilling Co. at its 1 Reuben Winter, SW NW NW 32-4s-10e, 3 miles northeast of Carmi, White County, also is getting active development and is proving an important discovery for the area. The discovery well, completed in O'Hara lime at 3,118-25 ft., is pumping approximately 300 bbl. of oil per day. It also had good saturation in Aux Vases sand at 3,025-42 ft. The discovery has been confirmed at 2 Reuben Winter, NE SW NW 32, a location southeast, which flowed 128 bbl. per day while testing Aux Vases saturation. In the meantime, the same operators are testing the Aux Vases zone at their 1 Rose-Campbell-Winter Community, NE NW SW 32, two locations south of 2 Reuben Winter, and the O'Hara zone at their 1 Winter-Botsch, NE SE NE 31, southwest of the discovery well. The other wells are drilling in the immediate area.

INDIANA

Indiana completions during the week included a wildcat producer located just southeast of the townsite of Dickeyville, in northern Warrick County. It is Tecumseh Coal Co. 1 Harold, SE NW SW 20-4s-7w which pumped 8 bbl. net oil from Aux Vases lime at 1,526-32 ft. after being acidized with a total of 5,500 gal. Total depth is 1,534 ft. Dickeyville is about 7 miles northeast of Boonville, the county seat.

Frank B. Murta & Son and Walter Willis 1 Montgomery, NE NW SE 5-3s-11w, 2 miles east of Owensville and ¾ mile east of production of the Owensville East pool, made 144 bbl. of oil in 24 hours after being placed on the pump. Pay zone is Cypress sand at 2,028-46 ft. It is being offset both to the north and the south.

WESTERN KENTUCKY

Production of the Zion North pool, 6 miles east of Henderson, Henderson County, has been extended a half mile to the north by Stanley Drilling Co. 1 Hardin heirs, C W½ NW NW 23-Q-25, which pumped 126 bbl. of oil per day on completion gage. Pay is lower McClosky at 2,288-94 ft. Location is midway between Zion and Spottsville.

One mile southwest of Spottsville and a half mile from production in that area, Felmont Oil Corp. is making a well at its 1 F. M. Hape et al, in 21-Q-25. Total depth is 2,380 ft. with casing run through Aux Vases sand saturation at 2,172-80 ft. On a previously reported drill-stem test, open 2 hours, it got gas in 45 minutes and filled 750 ft. of clean oil and 95 ft. of mud-cut oil

EASTERN KENTUCKY

A dual-zone completion came in last week in Big Sandy gas field as Kentucky-West Virginia Gas Co. finaled 980 Bud Maynard for 227,000 cu. ft. of gas daily from Big lime of Mississippian age and Devonian black shale. Total depth was 3,287 ft., and well was shot with 5,800 lb. of gelatin. Well is located on Brushy Fork in Pike County.

Also in Pike County on Rockhouse Creek, Kentucky-West Virginia Gas Co. has a good gasser at 5993 John H. Adkins. At total depth of 2,072 ft. well gaged 3,834,000 cu. ft. of gas daily from Maxon (Mississippian) sand topped at 2,042 ft. Well was not shot or acidized.

On Salt Lick Creek in the Knott County sector of Big Sandy gas field, a dry hole has been recorded at Kentucky-West Virginia Gas Co. 6021 William Bailey. Devonian black shale, the normal producing zone for the area, was dry at a total depth of 2,693 ft. Devonian was topped at 2,295 ft.

MICHIGAN

The brightest spot for a new oil-pool prospect on the Michigan wildcatting front this week was at Basin Oil Co., McClure Oil Co. and Swan-King Oil Co. 1 Adair, SE SE SE NW 13-16n-10w, Green Township wildcat, Mecosta County, which was report-

(Continued on page 128)

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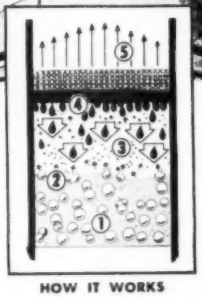

HOW IT WORKS

(1) Gas passes through liquid. (2) Bursting gas bubbles produce fine spray of liquid droplets. (3) Droplets are entrained in rising stream. (4) Droplets coalesce on knitted-wire surfaces to form large drops that fall back against the flow. (5) Gas passes on, freed from entrainment. The liquid is returned.

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Completions for First 11 Months Show Small Increase Over 1950

by Joseph A. Kornfeld

CUMULATIVE completions and drilling footages for the first 11 months of 1951 established another all-time high record. The total number of new wells completed from January 1 to December 1 was 40,535, an increase of 770 wells or 1.9 per cent over the comparable period during 1950. Footage drilled during the first 11 months of 1951 reached 156,321,865 ft., a gain of 11,556,453 ft. or 7.9 per cent over the comparable period last year.

Oil wells completed during the first 11 months of this year were 21,426 or 996 less than the comparable period in 1950. Gas wells finaled for the 1951 period totaled 2,680, up 996 from 1950. Dry holes in the 1951 period to date totaled 16,429, up 1,702 or 11.6 per cent over 1950. The abnormal reduction in oil-well completions and the big increase in dry holes, percentage-wise, are due to stepped-up exploratory operations.

Depth analyses. — Breakdown of completions by depth groups reveals that the shallowest depth class declined 7.7 per cent, while gains were registered in all other classifications. Completions in the 2,500-5,000 ft. class rose 5.8 per cent. Those in the 5,000-7,500 ft. group rose 7.6 per cent and a gain of 15.3 per cent was shown in the 7,500-10,000 ft. class. Completions in the 10,000-12,500 ft. category gained 15.2 per cent and those finaled in the deepest classifications, over 12,500 ft., rose 44.4 per cent.

November Comparisons

November 1951 completions totaled 4,038 wells; this marks a gain of 56 wells for a rise of 14.1 per cent over November 1950. Footage drilled during November 1951 totaled 16,227,904 ft., up 1,150,145 ft., or a gain of 17.6 per cent over the same month a year ago.

Southwestern. — New Mexico completions rose 44, up 188 per cent over a year ago; this development was divided between the shallow gas play in the San Juan basin and the deep drilling to the Lower Paleozoic rocks in the southeastern corner of the state. Texas completed 27 less wells than during November 1950, off 1.6 per cent.

Southern.—Mississippi increased 21 completions, a gain of 95 per cent; this marked the only plus sign in the region. Arkansas lost 8 wells or 17.4 per cent. Louisiana dropped 27 completions, off 11.8 per cent. The Eastern Gulf group of Alabama-Georgia-Florida lost 4 wells, off 57 per cent.

Rocky Mountain and West Coast.—Biggest percentage gain in this area came in Utah with 7 completions against none in November 1950. Colorado added 9 completions, up 60 per cent. Montana gained 12 completions, up 37.4 per cent. Wyoming rose 6 wells, up 10.7 per cent. California added 17, up 9.6 per cent over a year ago.

SUMMARY OF COMPLETIONS — NOVEMBER 1951

	Total comp.	Oil	Gas	Dry	Under 2,500 ft.	2,500-5,000 ft.	5,000-7,500 ft.	7,500-10,000 ft.	10,000-12,500 ft.	Over 12,500 ft.	Total footage	Rigs and drilling
New York	44	23	0	21	44	0	0	0	0	0	64,400	51
Pennsylvania	143	64	20	59	135	3	5	0	0	0	264,172	180
West Virginia	68	8	44	14	1	31	31	3	0	0	187,240	175
Maryland	7	0	3	4	0	0	6	1	0	0	29,117	53
Ohio	94	28	26	40	53	41	0	0	0	0	194,206	146
Kentucky	88	30	1	57	69	19	0	0	0	0	147,448	101
Illinois	188	63	3	122	62	126	0	0	0	0	487,002	280
Indiana	118	37	1	80	96	22	0	0	0	0	215,598	215
Michigan	70	22	1	47	36	34	0	0	0	0	185,034	144
Kansas	356	173	14	169	37	312	7	0	0	0	1,227,745	491
Nebraska	23	5	1	17	0	17	6	0	0	0	109,760	48
Oklahoma	524	284	17	223	149	252	82	26	14	1	1,991,159	935
Texas	1,605	920	78	607	397	554	451	162	34	7	7,500,408	1,787
North	280	129	3	148	123	122	35	0	0	0	859,344	212
West Central	243	112	3	128	90	120	33	0	0	0	812,653	187
West	463	372	2	89	72	92	238	42	15	4	2,660,019	711
Panhandle	83	32	36	15	6	71	3	3	0	0	282,881	122
Eastern	87	41	8	38	6	37	28	16	0	0	451,819	93
Gulf Coast	224	124	16	84	23	55	66	67	12	1	1,403,037	244
Southwest	225	110	10	105	77	57	48	34	7	2	1,030,655	218
Louisiana	201	116	15	70	40	46	29	40	34	12	1,312,754	312
Northern	106	62	10	34	39	39	19	6	3	0	462,181	130
Southern	95	54	5	36	1	7	10	34	31	12	910,573	182
Arkansas	38	25	0	13	7	23	4	4	0	0	153,225	43
Mississippi	43	8	0	35	0	5	25	11	2	0	301,910	43
Ala., Ga., Fla.	3	0	0	3	0	0	2	1	0	0	19,529	3
Montana	44	20	3	21	22	17	4	1	0	0	123,451	77
Wyoming	62	30	1	31	5	23	23	7	4	0	344,057	180
Colorado	24	10	0	14	3	5	15	1	0	0	116,472	82
Utah	7	1	1	5	0	2	2	2	1	0	46,736	43
New Mexico	94	39	36	19	30	32	13	9	7	3	445,585	221
California	194	134	3	57	67	77	37	5	5	3	783,203	296
Miscellaneous	92	0	0	2	0	2	0	0	0	0	6,673	15
Total November 1951	4,038	†2,040	268	*1,730	1,253	1,643	742	273	101	26	16,227,904	‡5,901
Total October 1951	3,884	2,014	296	1,574	1,369	1,533	620	244	93	25	14,840,935	5,998
Total November 1950	3,982	2,211	230	1,541	1,384	1,619	644	230	87	18	15,077,759	5,317
Cumulative 1951	40,535	21,426	2,680	16,429	13,455	16,771	6,888	2,402	1,011	208	156,321,865	
Cumulative 1950	39,765	22,422	2,616	14,727	14,570	15,874	6,216	2,083	878	144	145,765,412	
Alberta, Canada	144	83	15	46	24	45	70	1	4		637,787	
Cumulative 1951	1,158	734	99	325	132	532	473	16	5	0	4,702,747	
Cumulative 1950	935	700	39	196	73	592	258	11	1	0	3,672,756	

*Incl. 83 service wells: N. Y. 21, Pa. 52, Ohio 5, Mich. 2, No. Tex. 1, S. W. Tex. 1, S. La. 1. †Incl. 37 condensate wells: Kans. 6, W. Tex. 4, E. Tex. 4, Tex. Gulf 6, S. W. Tex. 5, Panhandle 1, S. La. 8, Canada incl. 3 gas condensate. ‡Incl. all wells rigged up and/or drilling at month end. §Incl. 1 N. Dak. at 4,145 ft., and 1 S. Dak. at 2,528 ft.

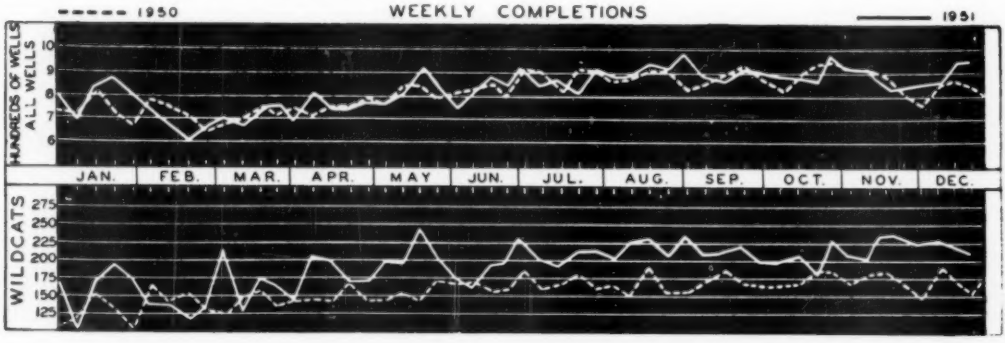
CURRENT STATISTICS

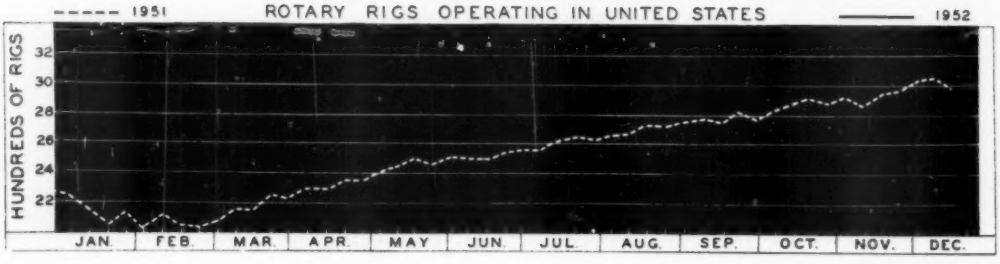
EXPLORATION

WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 22, 1951

	Total of all wells					Dec. 22		Wildcat completions and discoveries									
													Cumulative total, 1951				
	Comp.	Oil	Gas	Dry	Footage	1951	1950	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
New York	11	6	0	*5	16,500	632	652	0	0	0	0	0	0	0	0	0	0
Pennsylvania	32	18	1	†13	32,640	1,426	1,289	0	0	0	0	0	0	0	2	2	4
West Virginia	9	1	6	2	23,226	597	634	0	0	1	0	1	0	0	9	4	13
Ohio	19	8	5	16	41,854	959	1,010	0	0	0	0	0	1	0	6	27	34
Indiana	23	11	0	12	44,861	1,345	1,520	2	0	0	6	8	62	0	3	476	541
Kentucky	31	9	9	13	66,281	1,268	1,128	0	0	0	6	6	43	0	2	219	264
Illinois	34	16	0	19	80,792	2,306	2,812	1	0	0	7	8	90	0	0	709	808
Michigan	10	4	0	6	35,988	742	873	0	0	0	2	2	17	0	6	310	333
Kansas	108	45	10	§53	376,158	4,342	3,901	3	0	0	18	21	191	1	12	879	1,083
Nebraska	7	0	2	5	31,387	235	145	0	0	1	4	5	20	0	3	114	137
Oklahoma	105	63	5	37	417,424	5,463	5,346	1	0	0	9	10	182	5	21	718	926
Texas	394	230	24	140	1,987,793	16,341	16,241	16	0	2	84	102	736	54	129	3,419	4,338
North Central (Dist. 7-B & 9)	98	47	0	51	333,612	4,955	4,925	8	0	0	35	43	363	3	20	1,468	1,854
West (Dist. 7-C & 8)	128	100	3	25	747,660	4,998	4,911	3	0	0	16	19	177	10	9	636	832
Panhandle (Dist. 10)	18	8	10	0	50,700	708	878	0	0	0	0	0	2	0	0	33	35
Eastern (Dist. 5 & 6)	20	10	2	8	138,155	1,126	1,143	0	0	0	5	5	10	9	2	226	247
Gulf Coast (Dist 2 & 3)	75	39	8	28	494,276	2,279	2,270	4	0	2	12	18	95	22	60	479	656
Southwest (Dist 1 & 4)	55	26	1	28	223,390	2,275	2,114	1	0	0	16	17	89	10	38	577	714
Louisiana	53	30	4	19	382,668	2,169	2,407	2	0	0	12	14	46	10	8	303	367
Northern	27	12	4	11	104,107	1,201	1,302	0	0	0	7	7	16	0	5	182	203
Southern	26	18	0	8	278,561	968	1,105	2	0	0	5	7	30	10	3	121	164
Arkansas	8	4	1	3	26,820	417	397	0	0	0	2	2	15	1	2	84	102
Mississippi	6	3	0	3	44,737	371	298	0	0	0	2	2	17	4	1	152	174
Southeastern States	2	0	0	2	11,057	49	58	0	0	0	1	1	1	0	0	20	21
Montana	1	0	0	1	4,405	248	266	0	0	0	0	0	0	0	1	43	44
Wyoming	13	6	1	6	68,768	729	598	1	0	0	3	4	17	0	1	110	128
Colorado-Utah	12	3	0	9	65,266	316	110	0	0	0	6	6	15	0	7	141	163
New Mexico	18	12	0	6	118,101	705	601	3	0	0	5	8	16	0	10	84	110
California	47	40	1	6	207,839	2,295	1,803	1	0	0	6	7	59	0	6	462	527
Miscellaneous (N. D., S. D., Md.)	4	0	2	2	17,804	86	54	0	0	0	2	2	1	1	26	56	84
Total United States	947	508	71	368	4,102,369	43,041	42,143	30	0	4	175	209	1,538	86	245	8,332	10,201
Total previous week	945	524	49	372	3,839,826			28	2	4	185	219	1,508	76	251	8,157	9,992
Total December 23, 1950	847	498	59	290	3,280,011			21	1	2	128	152	1,109	72	207	6,447	7,835

Service wells included: *5, †12, 11, §3.





DAILY AVERAGE PRODUCTION FOR WEEK

	Dec. 22 crude oil	B. of M. Dec. demand	Dec. 15 crude oil
Alabama	2,800	2,400	2,800
Arkansas	77,665	84,000	76,560
California	988,900	995,000	988,300
Colorado	77,300	75,000	72,200
Eastern	57,000	61,000	57,500
Florida	1,775	1,600	1,650
Illinois	170,400	161,000	168,500
Indiana	31,200	31,000	32,500
Kansas	305,000	319,000	327,400
Kentucky	34,800	31,000	34,700
Louisiana	603,400	648,000	601,250
North Louisiana	113,850		111,700
South Louisiana	489,550		489,550
Michigan	37,800	40,000	37,600
Mississippi	98,410	102,000	96,545
Montana	26,000	26,000	26,600
Nebraska	7,600	8,000	7,600
New Mexico	148,625	155,000	148,725
Oklahoma	519,600	530,000	517,800
Texas	2,753,050	2,780,000	2,753,050
Dist. 1 (Southwest)	32,700		32,700
Dist. 4 (Southwest)	251,900		251,900
Dist. 2 (Gulf Coast)	163,300		163,300
Dist. 3 (Gulf Coast)	462,200		462,200
Dist. 5 (Eastern)	52,600		52,600
Dist. 6 (Eastern)	123,025		123,025
East Texas field	268,500		268,500
Dist. 7-C (West)	116,150		116,150
Dist. 8 (West)	956,825		956,825
Dist. 7-B (W. Central)	84,300		84,300
Dist. 9 (N. Central)	158,000		158,000
Dist. 10 (Panhandle)	83,550		83,550
Utah	4,400	5,000	4,300
Wyoming	189,000	190,000	188,000
Total United States	*6,134,725	6,245,000	6,143,580
Change from previous week, down	8,855		
Canada	138,300		133,229

Total U. S. production January 1-December 22 †2,186,861,719 bbl.
Same period last year (crude plus cond.) 1,929,037,830 bbl.

*Not. incl. 117,200 bbl. condensate. †Incl. 37,774,884 bbl. condensate.

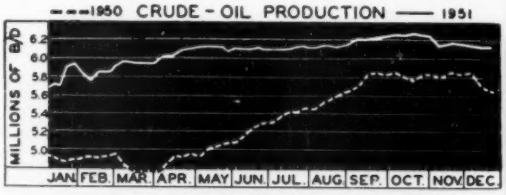
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

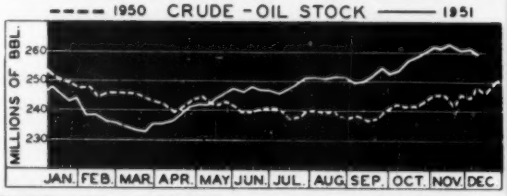
(Thousands of barrels)

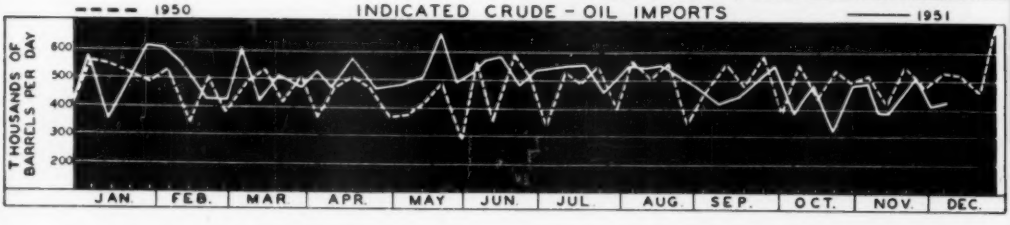
	Dec. 8, 1951	Dec. 1, 1951	Dec. 9, 1950
Pennsylvania Grade	2,017	2,086	2,129
Other Appalachian	1,792	1,867	1,257
Illinois, Indiana, Michigan	12,283	12,289	10,152
Arkansas	2,634	3,047	2,507
Louisiana	13,899	14,085	14,242
North	2,824	2,810	2,670
Gulf	11,075	11,275	11,572
Mississippi	3,371	3,546	2,344
New Mexico	8,038	6,931	6,742
Oklahoma and Kansas	40,885	40,207	38,135
Texas	126,075	128,216	119,497
East Texas	15,170	15,605	13,885
West Texas	53,408	54,874	46,235
Texas Gulf	28,487	28,198	29,416
Other Texas	29,010	29,539	29,961
Rocky Mountain	13,721	13,929	11,508
California	28,782	28,997	30,330
Foreign	5,588	5,701	7,499
Total	259,085	260,901	246,342

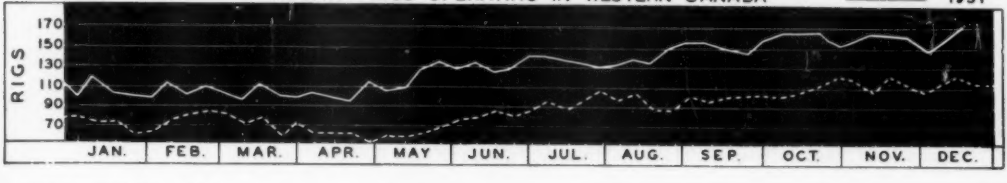
*Bureau of Mines.

(Data for December 15 not available at press time)







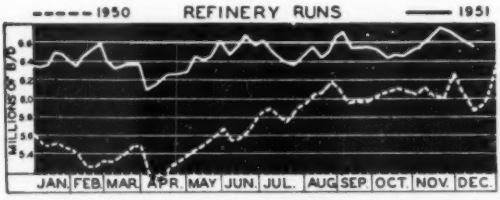


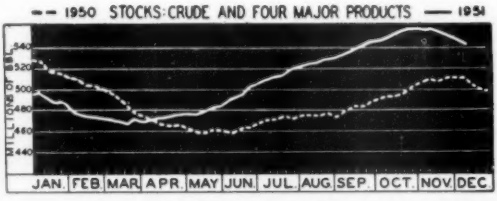
A.P.I. REFINERY REPORT, DECEMBER 15

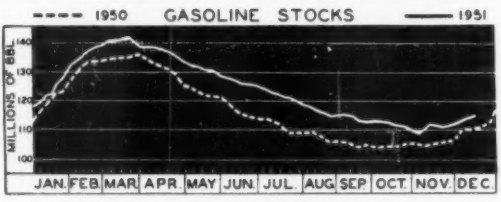
(Thousands of barrels)

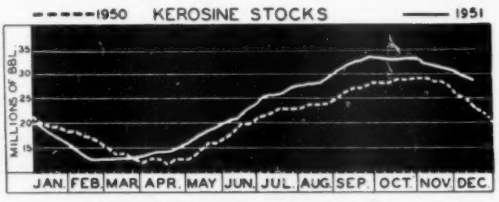
District	Daily avg. crude runs	Daily average production				Stocks at refineries, bulk terminals, in transit and in pipe lines				Bureau of Mines, December 1950				
		Gasoline*	Kerosine	Distillate	Residual	Gasoline†	Kerosine	Distillate	Residual	Daily avg. crude runs	Daily average production: Gasoline*	Kerosine	Distillate	Residual
East Coast	1,046	418.6	29.1	276.0	205.7	24,262	10,404	31,124	9,783	951	386.9	44.0	254.7	234.4
Appalachian:														
District 1	100	42.9	5.9	19.1	11.7	2,777	538	861	539	95	42.0	5.2	15.5	11.1
District 2	87	49.7	6.4	13.3	15.9	1,120	323	305	287	65	32.0	5.3	7.0	16.4
Ind., Ill., Ky.	1,234	634.6	75.9	235.2	177.6	25,776	6,333	17,818	6,007	1,103	550.6	75.9	200.8	173.6
Okla., Kans., Mo.	560	309.0	18.7	134.6	68.7	12,495	1,718	11,291	1,971	514	274.5	18.6	121.2	71.4
Inland Texas	240	175.1	13.3	35.0	43.4	4,094	492	1,753	1,408	214	147.3	12.9	31.6	41.0
Texas Gulf Coast	1,608	766.8	131.1	397.3	254.9	17,793	4,539	14,268	6,710	1,506	674.6	128.0	375.2	283.2
La. Gulf Coast	499	231.9	56.1	127.1	62.6	6,190	2,932	3,594	1,845	499	235.2	52.8	132.8	64.2
N. La. and Ark.	76	32.6	7.0	15.4	6.4	2,659	485	1,409	140	69	28.1	8.3	14.6	9.9
Rocky Mountain:														
New Mexico	15	8.4		2.9	3.9	123		73	35	15	7.9	0.3	2.7	3.5
Other Rocky Mtn.	212	101.4	5.9	51.1	46.7	3,873	304	1,577	979	213	99.7	7.1	42.8	46.0
California	876	411.3	11.0	160.1	354.4	13,650	366	7,576	14,453	900	399.9	4.9	143.9	351.0
Dec. 15, 1951	6,553	3,182.3	360.4	1,467.1	1,251.9	114,812	28,434	91,649	44,157	6,144	2,878.7	363.3	1,342.8	1,305.7
Dec. 8, 1951	6,610	3,197.3	386.4	1,444.7	1,284.7	113,590	29,293	94,270	46,218					
Dec. 16, 1950	5,925	2,893.4	323.9	1,266.3	1,223.9	110,943	23,152	76,913	41,598					

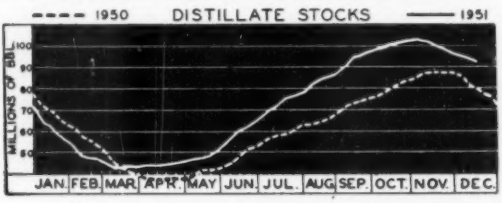
*At refineries including natural blended. †Finished and unfinished.

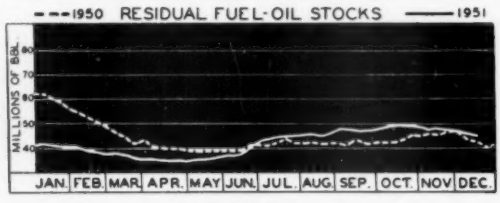


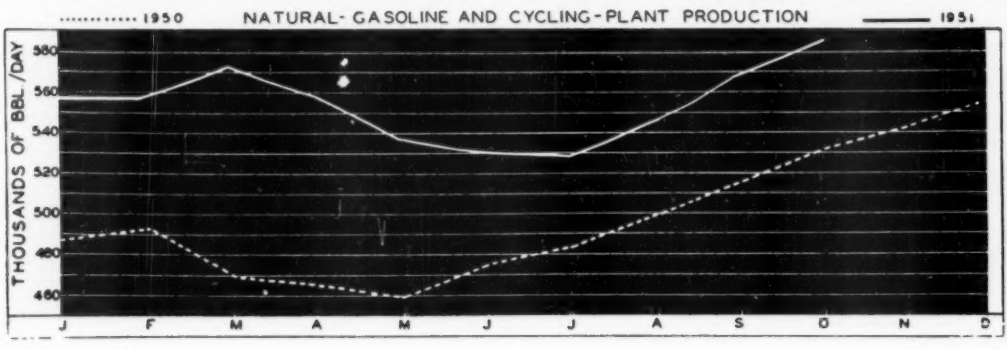












CRUDE PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.‡	Okla-homa, Kansas	Gulf Coast Tex.*	West Tex†
18-18.9	$1.93	....	....	....
19-19.9	1.98	....	....	....
20-20.9	2.03	$2.35	....	$2.12
21-21.9	2.07	2.27	....	2.14
22-22.9	2.12	2.29	....	2.16
23-23.9	2.18	2.31	....	2.18
24-24.9	2.24	2.33	$2.56	2.20
25-25.9	2.30	2.35	2.58	2.22
26-26.9	2.36	2.37	2.60	2.24
27-27.9	2.41	2.39	2.62	2.26
28-28.9	2.46	2.41	2.64	2.28
29-29.9	2.52	2.43	2.66	2.30
30-30.9	2.57	2.45	2.68	2.32
31-31.9	2.62	2.47	2.70	2.34
32-32.9	2.68	2.49	2.72	2.36
33-33.9	....	2.51	2.74	2.38
34-34.9	....	2.53	2.76	2.40
35-35.9	....	2.55	2.78	2.42
36-36.9	....	2.57	2.80	2.44
37-37.9	....	2.59	2.82	2.46
38-38.9	....	2.61	2.84	2.48
39-39.9	....	2.63	2.86	2.50
40 and above	....	2.65	2.88	2.52

*For crude from Daboval, El Campo, and Sand Point.

†Includes Lea County, New Mexico. Last general price change represented a 50-cent increase becoming effective December 6, 1947.

‡Standard Oil Co. of California

FLAT CRUDE PRICES

Representative posted schedules per barrel	
East Texas†	$2.65
Kettleman Hills, California*	2.80
Beauregard Parish	2.60
Illinois Basin	2.77
Pecos County, Texas (Yates)	2.35
Bradford, Pennsylvania	4.25
Eastern Ill. and Western Ind.†	2.77
Tomball, Texas Gulf Coast	2.83

*37-37.9°. †35° and above

THE decrease in imports of heavy fuel, brought about by the reduction in world supply with the closing of the Abadan refinery, is adding to the demand for fuel from refineries in this country. For the 5-week period ended December 15, indicated demand for heavy fuel from refineries in United States was 6.1 per cent greater than for the same period last year. On the other hand, residual imports were about 16 per cent less than in 1950. Calculated total demand, based on production at domestic refineries, imports, and stock changes, was about 1 per cent greater than in the same 5-week period last year.

Since almost all imports of residual come in at ports on the East Coast, the current drop in residual receipts has had a decided effect on markets along the East Coast and also in the Gulf Coast, since this is a major supply area for northeastern states. All fuels have been tight at Gulf Coast points for several weeks. Most of the heavy fuel has been scheduled for delivery to regular customers on the East Coast. Foreign buyers have found it increasingly difficult to buy residual from refineries located on the gulf and have been forced to purchase part of their needs from inland refiners.

Since some of the heavy fuel from the inland refineries normally is sold on the Group 3 market, all increases in movement of material to tidewater points tend to add to the demand at refineries in Oklahoma and Kansas. Continued cold weather in North Central states is boosting demand for residual in District 2.

Near-record production of gasoline at refineries has resulted in some softening of the Mid-Continent gasoline market. Also, weather conditions in the North Central area have reduced gasoline consumption enough to help depress the market.

REPRESENTATIVE QUOTATIONS

Representative spot-market quotations of leading suppliers as of December 24, 1951. Figures are f.o.b. plant for tank-car shipments in cents per gallon, except for residual fuel oil which shows the price per barrel and wax, in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline, 80-82 octane	10⅛-10½	12-12.75	10¾-11
Premium gasoline, 86-88 octane	11¼-11⅝	13.5-13.75	11¾-12
42-44 w.w. kerosine	9-9½	10-10.1	9
No. 2 straw fuel oil	8¼-8½	9-9.25	8
No. 6 residual	$1.65-1.75	$2.45-2.60	$1.75-1.90

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	6⅞	6⅜	6⅝
Grade 18-55	8.25	7.75	8.0

LUBRICATING OILS

South Texas

200 vis., No. 2-3 neutral	13-13.5
750 vis., No. 3-4 neutral	16
2,000 No. 5-6 neutral	18-19

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	29-30
200 vis., No. 3 neutral, 0-10 pp.	17.5-18.5

Western Pennsylvania

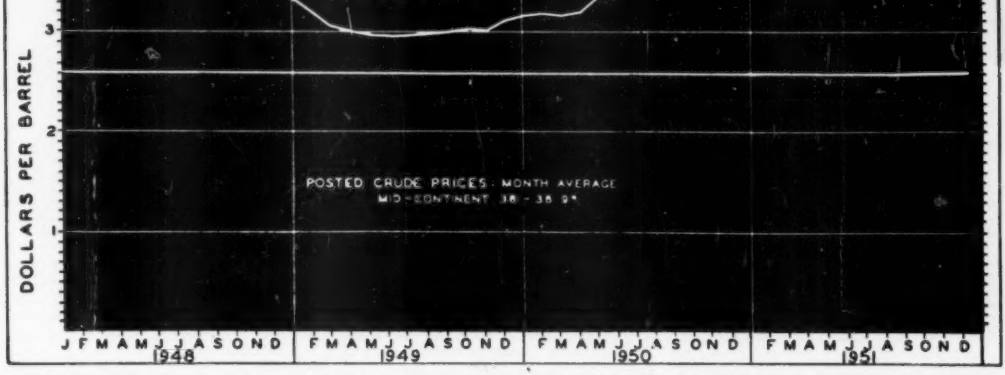
145-155 vis., 10 p.t. bright stock	32.5
180 vis., 0 p.t. neutral	31.5

WAX

Mid-Continent

132-134 A.M.P.	5.8

(Starting with the first issue of 1952, price quotations will be as of Wednesday each week instead of Monday)


PRODUCT REALIZATION
F.O.B. MID-CONTINENT REFINERIES
POSTED CRUDE PRICES: MONTH AVERAGE
MID-CONTINENT 38 - 38.9°
DOLLARS PER BARREL
3
2
1
J F M A M J J A S O N D
1948
F M A M J J A S O N D
1949
F M A M J J A S O N D
1950
F M A M J J A S O N D
1951

In this trend chart refinery realization is based on average Mid-Continent grade crude oil (not 38° gravity only) and average prices for refinery products as published in The Oil and Gas Journal basis Oklahoma (Group 3). Refinery yields confined to gasoline, kerosine, distillate, and fuel oil. Realization averaged $3.48 for week ended December 15, $3.48 for previous week, and $3.50 for December 1950.

EQUIPMENT MEN . . . in the News

Cameron Iron Works Organizes Canadian Branch

Herbert Allen, vice president and general manager of Cameron Iron Works, Inc., Houston, has announced the organization of Cameron Iron Works of Canada, Ltd.

The new subsidiary company will distribute Cameron products to Canadian oil operators through recognized oil-field supply companies operating in Canada.

N. G. Loudoun has been named as sales representative for the Canadian branch.

Founder of I. H. Grancell Succumbs at Los Angeles

I. H. Grancell, founder and head of the company of the same name, died suddenly at his home in Los Angeles on November 1. He was 73 years of age.

As developer and manufacturer of "Bestolife" tool-joint and casing compounds, Grancell was a well-known and familiar figure in the oil country for more than 20 years. Grancell's business was almost entirely built by personal contact and he lived to see "Bestolife" compound become one of the leaders in the field.

The business will be continued under the present management, headed by Mrs. Grancell. There will be no change in the sales and distribution policies.

Massillon, Ohio, Welcomes Griscom-Russell Co.

In November the Chamber of Commerce of Massillon, Ohio, gave a "get acquainted" dinner party at the Massillon Club to welcome the executives and key personnel of The Griscom-Russell Co. who had recently settled in the city.

Nearly 125 men attended the dinner, at which official greetings were extended to the Griscom-Russell newcomers by S. Robert Weirich, mayor of Massillon; Perry M. Angstadt, president of the Massillon Chamber of Commerce; and C. R. Finefrock, chairman of the committee which arranged the dinner.

Responding to the welcome were Kenneth B. Ris, president of Griscom-Russell, and E. H. Townsend, secretary-treasurer, who delivered a message from T. K. Stevenson, chairman of the executive committee, who was unable to attend the dinner.

The move of the Griscom-Russell staff to Massillon centralizes the operations of the company at this location.

Thornhill-Craver Names Canadian Representative

Delbert D. Lewis, of Import Tool Co., Edmonton, Alta., Canada, has been appointed Canadian representative for Thornhill-Craver Co., Houston.

Lewis formerly served as drilling superintendent for Standard Oil Co. in Venezuela for a number of years and was field superintendent for Newell & Chandler in Turner Valley field in Alberta. He also served with Creole Petroleum Corp. in Venezuela.

Lewis' head office is at Edmonton and warehouses are located at Calgary and Stettler.

Southern Geophysical Opens Division Offices in Denver

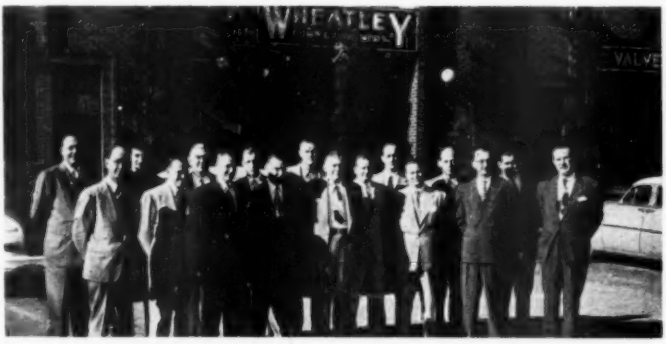
E. F. BLAKE

Dr. Sidon Harris, president of Geophysical Co. of Fort Worth and Midland, Tex., has announced the opening of division offices in Denver to service the company's rapidly growing Rocky Mountain operations. Elmer F. Blake, who has been with Southern for 3 years, will be in charge of this division.

Southern now has several crews operating in Montana, Wyoming, Colorado, and surrounding states.

In establishing the Rocky Mountain division, Blake is returning to familiar territory since he has been in geophysical work for the past 18 years, having served with Western Geophysical Co. and National Geophysical Co. before joining Southern early in 1949. His geophysical experience has been in the Rocky Mountains, West Texas, South and East Texas, New Mexico, Colorado, Wyoming, Montana, Kansas, Louisiana, and Arkansas.

Wheatley Firms Hold Joint Sales Meeting



Charles Wheatley Co. sales group and the executive and engineering department of Frank Wheatley Pump & Valve Manufacturer held a joint sales meeting in Tulsa on November 26, 27, and 28. Those in attendance were, front row, left to right: Fred King, Tulsa salesman; H. Abernathy, Frank Wheatley fabrication manager; L. J. Patterson, Tulsa salesman; R. Hellinghausen, Oklahoma City manager; H. D. Richardson, Shreveport manager; O. Sumner, Frank Wheatley service department; Frank Wheatley, Jr., executive vice president of Frank Wheatley; Huber Dye, manager of Charles Wheatley Co., and J. H. Withers, sales manager. Back row, left to right: W. E. Wagner, Dallas manager; Lloyd Gray, Bartlesville, manager; R. U. Hackenjos, Odessa manager; R. E. Bleigh, Tulsa salesman; John Fitzpatrick, Charles Wheatley engineer; Harold Putnam, Tulsa salesman; John Burris, chief engineer for Frank Wheatley, and Tim Kirk, Houston manager.

Waukesha Sales Names Key Promotions

Promotions for a number of key personnel and the addition of four new salesmen for Waukesha Sales & Service, Inc., were announced recently by Louis M. Pearce, Jr., president of Waukesha, Houston.

Walter Buehring, former district manager in the New Iberia area, has been named to the newly created position of service parts manager. H. N. Carter, former branch manager in the Corpus Christi area, has been named as Buehring's assistant.

J. B. Krenek, former branch manager of the Waukesha Kilgore store, has been named district manager of the New Iberia territory. M. D. Russell, former parts manager in the Kilgore store, will succeed Krenek as branch manager.

In other changes, Frank Williams, former sales engineer, was promoted to district manager in Houston. G. C. Shows was named branch manager at Houston.

New sales engineers added to Waukesha's organization include Leon Miller, sales engineer for the Pampa, Tex., area; G. C. Sies, sales engineer, Odessa; Harry Goss, sales engineer, Houston, and Bert Coleman, sales engineer, Houston.

LeBus Forms New Wichita Falls Firm

F. L. LeBus, Sr., has announced the formation of LeBus International Engineers, Ltd., Wichita Falls, Tex.

LeBus International has been organized exclusively for the purpose of promotion and development of wire-line spooling methods. Sales and service for the new firm will be on an international scope. The LeBus Rotary Tool Works, Inc., Longview, Tex., will continue to manufacture all materials.

Earl J. Calk will act as sales manager and F. L. LeBus, Jr., will operate out of the Longview office on sales and material distribution. The new company will retain the same sales organization that previously sold this type of service for LeBus Rotary Tool Works, Inc.

Babcock & Wilcox Tube Is Absorbed by Parent Firm

Babcock & Wilcox Tube Co., a wholly owned subsidiary of Babcock & Wilcox Co., will be dissolved, effective at close of business December 31. The tube company's business and assets will be absorbed by, and it will be operated as, one of the divisions of Babcock & Wilcox Co.

The announcement, made jointly by the boards of directors of both companies, emphasized that the transfer of the plants and business of the tube company will have no effect upon its continued operation so far as the customers and employes of the subsidiary are concerned and will not change Babcock & Wilcox Co. stockholders' equities.

The tube facilities will be operated as the tubular-products division of the company and Luke E. Sawyer and Edward A. Livingstone, tube company officers, will also become officers of Babcock & Wilcox.

Whitmor Building Ninety New Midland-Area Homes

Partial view of Sohio's Glasscock camp before completion.

Contracts totaling more than $1,000,000 for four industrial-housing projects in the Midland, Tex., oilfield area have been awarded to Whitmor Homebuilders, Inc., Tulsa, according to an announcement by Burl Johnson, vice president of sales.

Completion of these projects is expected by March 1952. All crews employed on the Midland projects (250 workmen under 4 superintendents, with a general superintendent in charge) have been transferred as a unit from Tulsa.

To coordinate and direct work on these and other Midland-area projects, Whitmor has established headquarters in that city under H. E. Wicker, full-time general superintendent.

Largest of the four projects is the construction of 54 houses for Sohio Petroleum Corp. Thirty of these houses will be in Midland and 24 at the company's Glasscock camp, 40 miles south of that city.

Thirteen homes are under construction at the Stanton Camp of Humble Oil & Refining Co., and 11 more for Magnolia Petroleum Co. at the latter's Pegasus natural-gasoline camp, 30 miles southwest of Midland.

At the Tex-Harvey gasoline-plant campsite, Whitmor is at work on 10 houses for field men and their families.

All 90 houses involved in the 4 projects are complete, conventionally built 6-room homes. The houses for Humble and Magnolia are being built to specifications and plans of those companies, while the Sohio and Tex-Harvey houses have been designed by the builders.

Universal Atlas Names Five Executives to Higher Office

Election of five executives to higher office by directors of Universal Atlas Cement Co. was announced recently by Blaine S. Smith, president of this United States Steel subsidiary.

George H. Reiter, vice president and general sales manager, was elected to the newly created office of executive vice president; Fred T. Wiggins, vice president and assistant general sales manager, was elected vice president and general sales manager; Charles B. Baker, assistant to president and secretary, was elected vice president and general attorney; Donald C. Leo, assistant secretary, was elected secretary, and Attorney Edward P. Depew was elected assistant secretary. All of these appointments were effective as of December 1, with offices in New York City.

Blaw-Knox Licensed to Use Houdry Processes, Designs

Chemical Plants Division of Blaw-Knox has been licensed by Houdry Process Corp. to use certain of the latter company's processes, designs for equipment, and technical information relating to catalytic treatment of petroleum and other hydrocarbons. This further enables Blaw-Knox to offer services in the engineering and construction of plants and processing facilities to the refining and petrochemical industries.

Tulsa Equipment Moves To New Headquarters

Tulsa Equipment Co.'s new location.

Tulsa Equipment Co., Inc., just completing its seventh year of business, has moved from its downtown location to a completely new building with 5,000 ft. of floor space for show rooms, offices, and parts and service facilities. One of the fast-growing divisions of the company is its rental department.

The company was launched in 1944 by F. L. Squires, president, who has had 18 years' experience in the field of contractor supplying. C. L. (Shorty) Edwards, vice president, is a veteran with 22 years of selling contractors equipment in the eastern Oklahoma area, while Bill Fuller, salesman and

secretary-treasurer, serves as the third officer in the organization.

The company serves as distributor in Oklahoma for products of Insley Manufacturing Co., the Baldwin-Lima-Hamilton Corp., Worthington Pump & Machinery Corp., Electric Steel Foundry Co., Gates Rubber Co., Rogers Bros. Corp., Spencer Safford Loadcraft, Inc., Erie Steel Construction Co., Perfection Steel Body Co., Getman Bros. Co., Calumet Hecla Co., M. R. S. Manufacturing Co., N. P. Nelson Iron Works, Lewis-Browning Manufacturing Co., and Madsen Manufacturing Co.

Despite its relative newness in the field, Tulsa Equipment Co. last year chalked up the enviable record of being fifth highest in the nation in the sale of Insley power shovels and cranes.

Humberstone Elected a Vice President of Air Reduction

Joseph H. Humberstone has been elected a vice president of Air Reduction Co., Inc. He was formerly president of the company's Airco Equipment Manufacturing Division, and he has been succeeded in that capacity by Scott D. Baumer.

New Geophysical Survey Corporation Is Organized

Virgin Kauffman, president of Aero Service Corp. of Philadelphia, and C. H. Frost, president of Frost Geophysical Corp. of Tulsa, announce the organization of Frost Airborne Survey Corp., with headquarters in Tulsa. The principal activities of the new survey corporation will be the conduct and interpretation of aeromagnetic surveys for the oil industry, and the devolpment of improved aeromagnetic instruments, procedures, and interpretations. The new corporation is licensed, under certain basic patents issued to Gulf Research & Development Co. of Pittsburgh, to perform aeromagnetic surveys for oil structures and minerals.

C. H. Frost entered the geophysical industry in 1930 when he and two others organized Seismograph Service Corp.

Dr. Joseph A. Sharpe, vice president of Frost Geophysical Corp. since 1945, has been selected as president of Frost Airborne Survey Corp. Sharpe was formerly associated with Stanolind Oil & Gas Co. as a research geophysicist for 2 years, after which he was promoted to the post of chief physicist, which position he occupied until his affiliation with Frost Geophysical in 1945.

Frost Airborne Survey Corp. has acquired the facilities, equipment, and personnel formerly employed by Frost Geophysical Corp. in aeromagnetic surveys, and in the development of improved instruments, procedures, and interpretation for such surveys.

Tayor Instrument Names Changes in Sales Staff

Raymond E. Olson, newly elected president of Taylor Instrument Companies, recently announced several major changes in the supervision of

F. S. WARD

A. J. FLEIG

the sales department. Olson was formerly vice president and general sales manager.

Frank S. Ward, Scottsville, N. Y., who since 1945 has been industrial sales manager, has been appointed to replace Olson as general sales manager. Ward started in the order department of the company in 1917.

Albert J. Fleig has been named to replace Ward as industrial sales manager. Fleig joined the organization in New York in 1919. Since 1945 he has been divisional sales manager in charge of sales to the chemical, petroleum, and canning industries.

George E. Heller has been made manager of a new industrial sales division handling products sold to the chemical industry. Heller joined the firm in 1935 and was sent to the Atlanta office to do application engineering in the textile industry. Returning to Rochester, he entered the application engineering department working with the dairy and chemical fields, and last March he became associated with the industrial sales department.

Richard N. Pond becomes a divisional sales manager handling the rapidly growing sales of industrial instrumentation to the petroleum industry as well as the canning industry. Pond started in 1941 as a member of the application engineering department. He entered sales work first in 1945 as a field representative in St. Louis and in 1949 as a member of the Rochester office staff.

National Tube Names Bacon Division Sales Manager

James P. Bacon has been appointed manager of sales, tubing specialties division, for National Tube Co., it has been announced by L. J. Mason, vice president of this United States Steel subsidiary.

Bacon formerly was district representative in the tubing specialties division of the company in New York. He started with National Tube in 1939 in the accounting department and moved into the sales field in 1943. In 1948 he was named office manager of the sales department at the Ellwood (Pa.) works.

Pittsburgh Coke Opens Chicago Sales Office

The Pittsburgh Coke & Chemical Co., Pittsburgh, has announced the opening of an office in Chicago to direct the sale of the company's industrial protective coatings in the Midwest.

Joseph R. Robinson will be in charge of the sale of pipe-line enamels and the sale of synthetic coatings will be under Ralph G. Mensch.

Powell Is Named Emsco Executive Vice President

William T. Powell has been elected executive vice president of Emsco Derrick & Equipment Co., a new position created by Emsco's board of directors. Powell has been with Emsco 14 years and has served as vice president for 9 years.

Fenwal Appoints Maguire Louisiana Representative

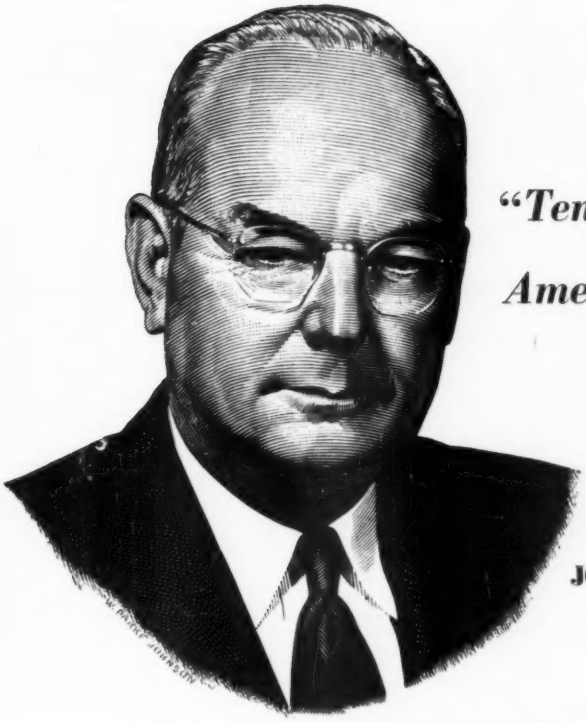
Fenwal, Inc., Ashland, Mass., manufacturer of thermoswitch thermostats for precision temperature control and detection, has announced the appointment of Joseph P. Maguire as its new sales representative for Louisiana, with offices in New Orleans.

He will handle sales and engineering services in connection with the company's thermoswitch units for standard and special temperature-control applications, "Detect-A-Fire" fire detectors, aircraft fire and overheat detectors, and aircraft temperature controls.

M. N. Aitken Co. Names E. A. Erickson to Staff

M. N. Aitken Co., Houston representative for Conoflow Corp., announces the appointment of E. A. Erickson to its sales-engineer staff. Well known in the instrument and control field, Erickson has been associated for some time with Houston engineering firms, where he was in charge of purchasing and sales of control and regulating equipment.

Aitken Co., which specializes in gas, oil, and chemical equipment, services the eastern Texas and western Louisiana region as well as Houston, with Cono controls.



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JOHN W. SNYDER
Secretary of the Treasury

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- On September 30, 1951, individuals held Series E Bonds totaling $34.6 Billion—more than $4.6 Billion greater than on V-J Day.
- In the January-September, 1951, period, 33,418,000 $25 E Bonds were purchased—a gain of 17% over the same period of 1950. 8,966,000 $50 E Bonds were sold in the first nine months of 1951. *$25 and $50 denominations are the bonds bought by Payroll Savers.*

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LIGHT PLANTS: New and rebuilt. Witte & Shepherd. Diesel Light Plants, 5 to 15 KW., A. C. 60 Cycles, 110-120 Volts. Single or 3 Phase. Priced to sell. Irick Electric Co., Inc., Box 928, Gallup, New Mexico.

FOR SALE: One super model Wilson single drum servicing unit, 80 hp. Waukesha 1,000' wire, all tubing tools, mounted on GM 4-wheel drive truck. $3500. Phone Rogers Pipe and Supply Co., Tulsa, Okla.

FOR SALE at our El Dorado (Oil Hill) Kansas Warehouse, one 10-20 McCormick Deering Steel Wheel Type Tractor with Shaffer, Jr., Front End Winch. $350. Also Model FS-35 Cardwell Skid Type Pulling Winch Powered by Ford Motor. $750. No Masts. Cities Service Oil Company, Partridge, Bartlesville.

COMPLETE mounted Rotary drill rig. Ballbearing throughout. Steel Derrick 5½x 10 Mud pump. 2⅞ drill pipe. Drill Oil or Water 2,000 feet. Fast rig. 2 men operate. Money maker. Box 106, Seminole, Oklahoma.

USED Baash-Ross block-hook combination, 150-ton, four sheave 1⅛" $2300. Good condition. General Equipment Co., Inc., 815 Daniel Bldg. 2-6764, Tulsa, Okla.

3800' 8⅝"; 2100' 10¾"; 1300' 13⅜"; 325' 16½"; for cash to best buyer—all seamless except 16½"—in good condition. At El Dorado, Kansas. Tel. #18—Mr. Collins—1643 W. 6th St.

2300' 5½" Lapweld Casing 17-20 lb. used, but in good condition. $2.00 ft. Phone 88, Pawhuska—Mr. Hudson.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-56 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: **W. H. ORR**
Phones: 132—**Rockdale, Texas**
AT-3427—Houston, Texas

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36" Filter Press, open delivery, 27 chambers, wood plates.
36" Sperry, Type 47, 26 frames, hydraulic closure.
8' x 12' Feinc, all steel.
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#7 Sweetland, 2" spacing, 28 leaves available.

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Machinery & Equipment Merchants

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SPUDDERS, rotaries, core drills. New and reconditioned equipment. Tools, cable, drill pipe, casing, tubing, pump jacks in stock. Everything for well service. Fishing tools rented. Pressey & Son, Pueblo, Colo.

7500' OF API Full Hole 4½" Drill Pipe. Graded and tested by Sonoscope engineers. Milford Giffin, Giffin Hotel, Tel. 477, Hoisington, Kansas.

PIPE
All sizes; line pipe and casing, tanks, and Oilfield supplies. Edco Pipe & Supply Co., Phone 98434, P.O. Box 4193, Tulsa, Oklahoma.

JACKS, JACKS, JACKS—I have a limited amount of Jenson Jacks new and used. A. R. Daniel, Garnett, Kansas.

FOR SALE: Two 3000 bbl. Butler bolted tanks good condition. Can ship immediately. Wentz Fuel Oil Company, 1012 N. 16th St., Lincoln, Nebraska.

MODEL S Cardwell draw works powered by W.A.K. Waukesha gas butane motor, Model WS Cardwell mud pump unit consisting of Model 16-P Wilson Snyder 6 x 16 mud pump, and Model 6 W.A.K. Waukesha gas-butane motor; 87' Lee C. Moore Cantilever drilling mast complete with substructure; 7500' practically new 2⅞" drill pipe with tool joints; Drill collars, light plant and all auxiliary equipment including hand tools. Very complete. Available for inspection West Texas. Box E-509, The Oil and Gas Journal, Tulsa, Okla.

SURPLUS PUMP BARGAINS
Unused Peerless, 6-stage deep-well pump, size 4", less power unit, capacity 200 GPM at 175' head.
Unused Gould, 8-stace centrifugal pump, size 3", figure 3360, less power unit, capacity 165 GPM at 800 PSI pressure.

THE FINN EQUIPMENT COMPANY
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Reconditioned, double drum, Wilson Giant Model Drilling Rig with double 87 ft. telescoping mast poles with racking platform, driven by Model EKU Waukesha reconditioned 180 H.P. engine. 12½ inch slightly used Brewster Rotary Table, long sub base with all the foregoing mounted thereon. One 4 ft. fabricated drill pipe sub-structure for above unit.

One reconditioned 7¼ x 12 Model FXZ Gardner-Denver Power Pump driven by reconditioned Model NKU Waukesha 220 H.P. Gas engine. Pump and engine mounted on extended sub base complete with V-Belt drive and guard.

Rig may be inspected in operation in Borger area.

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USED rotary and cable tool drilling tools, wire lines. E. A. Kelly, Box 861, Oklahoma City. Phone 5-6407.

AS IMPORTERS of Steel we can furnish you with European or Japanese Steel Products of all types. Let us have your inquiries. Hemisphere International Corp., 1404 Hibernia Bank Bldg., New Orleans, La.

THREE 4⅜" x 30' Drill collars. American overshot. One 9" x 25' Drill collar. One elevator for drill pipe. Kiowa Drilling Company, Inc., 717 Union National Bank Building, Wichita, Kansas.

Two 175 H.P.

Heine Boilers Type "M"

H.W.T. 250 lb. pressure
Boilers in good condition
Priced right

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Perfect Condition

6 in. diam., 20 ft. long 150 lbs. working pressure; standard nipples and flanges.

Price $200.00 each

4 in. diam., 30 ft. long, 150 lbs. working pressure. Heavy duty standard bronze couplings.

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All neoprene, oil resisting with steel coil core. Replacement will cost more than three times the above price. Stock up now while it lasts.

G. Peters

430 Dauphine St.
NEW ORLEANS 16, LA.

EQUIPMENT FOR SALE

10,000 FT. of good used 5½ OD plain end line pipe. Priced low. Lee Morrison Supply Co., Phone 277, Box 230, Bartlesville, Oklahoma.

KEYSTONE spudder, trailer mounted, truck and tools. Located Washington County, Oklahoma. Working on seven hundred foot well. Box E-385, The Oil and Gas Journal, Tulsa, Oklahoma.

EQUIPMENT WANTED

WE BUY well drilling equipment, machines, cable tools, pipe, etc. Turn your surplus equipment into cash. Pressey & Son, Pueblo, Colorado.

WANTED: Truck or Trailer mounted rotary for 3000 to 4000 foot drilling, also tools and pipe. Box 650, Great Falls, Montana.

WANTED: Triplex Type Pumps, minimum 500 barrels per day capacity at 1,000 PSI and 0 to 10 PSI suction and up. 1" Regular Black Line Pipe; 1" long collar line pipe and 1¼" upset tubing. Must be in good condition. Lynch Oil Company, P. O. Box 814, Evansville, Indiana.

We Wish to Purchase
1950-1951
Bucyrus-Erie Spudder
either a 48-L or 36-L
Keta Gas & Oil Co.
Terminal Building Bradford Penna.

HELP WANTED

EXPERIENCED petroleum refinery process engineer with good prior training in both process engineering and plant operation. If you have satisfactory training and experience the position is in line for top job in a Mid-Continent refinery. Box E-488, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Petroleum chemist or treating engineer with two to four years' experience in gasoline treating for technical service with large chemical company selling to the petroleum industry. Position involves considerable traveling in East and Middlewest. Please include details of education and professional experience, as well as a recent photograph, in first letter. Box E-508, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMOGRAPH Excellent opportunity for experienced geophysicist with aggressive independent contract company to supervise contract crew. Salary dependent on experience. Write giving details, all replies held strictly confidential. Box E-513, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGISTS with masters degrees having 3 years or under experience. Petroleum Engineers with 1½ or more years well work experience. Experimental geophysicists under 40. Experienced landmen with law degrees under 35. Topographical draftsman. Excellent employer. Good salaries. Experienced oilwell supply storemen, store managers and salesmen. No fees. Tom Robinson, owner Oil Industry Employment Service, 405 Tuloma Bldg., Tulsa, Okla. 4-5974.

DESIGN ENGINEER WANTED

Southern California manufacturer needs a design engineer, experienced in valves and fittings for the Oil Industry. Permanent position with excellent future. Please submit outline of formal training and experience. Mail to Box E-501, The Oil and Gas Journal, 211 S. Cheyenne Ave., Tulsa 1, Oklahoma.

WANTED FOR CHEMICAL PLANT LOCATED IN SOUTH
ESTIMATORS

Must be experienced engineers, under 45, familiar with Refinery and Chemical Plant design and capable of estimating process equipment installations from flow diagrams and specifications. Give full information, experience record and salary expected in first letter. All replies confidential. Box E-519, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

REFINERY Chief Engineer 26-40 with experience in both process and mechanical engineering; should be qualified to supervise mechanics of modern refinery with catalytic operation. Contact The Derby Oil Company, Wichita, Kansas.

ENGINEERS, geologists, draftsmen, geophysical field men, etc., write for information on Rocky Mountain area oil jobs. Professional Placement Service, 516 University Bldg., Denver, Colo.

ENGINEER to handle office detail and engineering work. Includes application of pumps for oil industry. Location Tulsa. Position leads to advancement to sales Engineer. Applicant should be graduate Mechanical Engineer, 25-30 years of age. Write giving age, education, salary desired, and experience if any, direct to Goulds Pumps, 20 East Archer, Tulsa, Oklahoma.

ENGINEERS, Executives, Technical Men. Salaried positions—$3600 to $30,000. This confidential service for outstanding men who desire a change of connection. Will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tomsett Associates, 334 Frick Bldg., Pittsburgh 19, Pa.

KEY Seismograph Personnel Needed by Established and Expanding Seismograph Company. Box E-264, The Oil and Gas Journal, Tulsa, Oklahoma.

DISTRICT GEOLOGIST: Aggressive independent oil company desires to hire experienced Geologist for Tulsa headquarters. Experience in West Texas-New Mexico are highly desirable. Box E-514, The Oil and Gas Journal, Tulsa, Oklahoma.

SHIFT SUPERVISOR—Responsible for supervision of Catalytic Cracking and Poly Plant operations, plus general supervision over process workers during shift. Must be experienced and thoroughly familiar with all phases of refinery operation. Location—Artesia, New Mexico. Write New Mexico Asphalt & Refining Company, Artesia, New Mexico, giving full particulars of qualifications, experience and references.

TECHNICIAN with all around experience on gasoline tests including CFR engine knocktesting. Required for Laboratory in Oklahoma. Reply stating salary expectation. Box E-518, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Subsurface geologist with 3 to 5 years experience in subsurface mapping in North or West Texas area. Include details of education and experience. Replies confidential. Box E-520, The Oil and Gas Journal, Tulsa, Oklahoma.

ADMINISTRATIVE and field sales personnel. Engineering education and/or background necessary. Knowledge of petroleum and chemical industries desirable. Apply: The J. B. Beaird Company, Inc., P.O. Box 1115, Shreveport, Louisiana.

ROCKY MOUNTAIN AREA oil jobs our specialty. Engineers, geologists, draftsmen, geophysical field men, etc., write for information. Professional Placement Service, 516 University Bldg., Denver, Colo.

OIL JOBS, Rocky Mountain Area, for engineers, geologists, draftsmen, geophyhical field men, etc. For information write Professional Placement Service, 516 University Bldg., Denver, Colo.

SITUATIONS WANTED

GRADUATE mechanical engineer, 2 years experience in drilling and production, desires work in production. Will locate in southwest, west coast or foreign. Will be released from Air Force latter part of January. Box E-512, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST desires change. Four years experience in southern Oklahoma, three with a Major Co. and one with an independent. Box E-517, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas, and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No 131, Ph. No. 131, Hobbs, New Mexico.

SITUATIONS WANTED

GEOLOGIST—Woman with initiative, 9½ years exceptional subsurface experience Texas and Mid-Continent. Unmarried. M. A. —89 hours geology. Desire good position with future. Box E-505, The Oil and Gas Journal, Tulsa, Okla.

REFINERY SUPERINTENDENT, experienced 5,000 to 10,000 bbl. plants, desires connection with independent refinery. Box E-510, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM CHEMIST, B.S.: 30 years experience in refinery laboratory and refinery operation. Available at once. Prefer Midwest or Southwest location. Box E-523, The Oil and Gas Journal, Tulsa, Oklahoma.

MAN, aged 46, member AAPG, thoroughly versed Louisiana geology, with actual experience drilling, leasing, curative work, desires connection with independent or small company operating Louisiana. Salary and interest open. Box E-522, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: Age 35, married, 13 years major and independent company experience in Texas and Louisiana Gulf Coast, Southwest Texas, West Texas-New Mexico, Colorado-Nebraska. Desire connection with Active independent. Excellent references. Box E-521, The Oil and Gas Journal, Tulsa, Oklahoma.

CIVIL ENGINEER, 3½ years experience refinery maintenance and construction with major oil company. Will consider foreign and domestic service. Box 1001, Sunburst, Montana.

EXECUTIVE POSITION DESIRED

Tweny years Gulf Coast experience in geology, leasing, and producing oil. Presently employed, but desire change to an independent firm who is looking for an elert, aggressive man who can find you the oil. Want compensatory salary and opportunity of participating in profits. **Box E-515, The Oil and Gas Journal, Tulsa, Oklahoma.**

AVAILABLE
Production Superintendent or Chief Engineer

Graduate Petroleum Engineer, Geological option, middle thirties, advanced from roustabout through chief engineer to assistant superintendent. Association with major and 18,000 BD independent. Experience throughout Mid-Continent; Gulf Coast limited. Complete background in drilling, production and reservoir engineering, production supervision, and limited gasoline plant operation. Well known in Mid-Continent, top references. Available after thirty days notice, salary consideration reasonable, major or reliable independent. **Box E-516, The Oil and Gas Journal, Tulsa, Oklahoma.**

FOR SALE—MAPS

NORTH DAKOTA and South Dakota Base Maps—County outline, Township and Range, location of wells and Operators name with total depths. Oil and Gas Fields. 1" — 8 miles. Price $5.00 each. County Maps: Fee ownership and lease with expiration dates. Scale 1" — 4,000 ft. Northwest Mapping Co., 1171½ Fourth St., Bismarck, North Dakota.

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Millions of acres now leased by world's major companies, with huge drilling play in prospect. For booklet describing Montana geology and oil development, write Landowners Royalty Company, Box 1225 Great Falls, Montana.

LEASE AND DRILLING BLOCKS

OIL LEASE — Approximately 800 acres, Beauregard Parish, Louisiana. 585 acres in Section 19 & 30, Township 2, Range 7, 80 acres in Sec. 6, Township 3, Range 8, 105 acres in Sec. 1, Township 3, Range 9. Lands in deep pay area, much activity. All surrounding acreage leased. Personal interviews. Alice Dickinson et al. Tel. 6 R, Lake Arthur, Louisiana, for appointment.

WILL pay cash instantly for leases (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2183, Denver, Colorado.

CAPITAL immediately available for geologically attractive Drilling deals and oil producing properties. Send full particulars. Box E-434, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS property for sale in Wolf County, Kentucky. Three million feet open flow from twelve wells in the salt sand. These wells are scattered over a large acreage. There is a good market fourteen miles away. This property is on a good road. 2205 Bath Ave., Ashland, Kentucky.

200 ACRE oil lease, need $4,000.00 for a ½ interest to drill well to Arbuckle. Dutcher sand was 100 feet high in this well. Good possibilities. L. Price, Coweta, Okla.

WILL furnish leases on personally owned proven and semi-proven oil lands, on mutually favorable terms to reliable parties who will drill 5,000 feet if necessary. E. L. Stratton, Pecos, Texas.

WEST—Wyoming 160 A. Royalty bargain in shallow gas field near General Pet. deep oil producer. R. O. Barnsley, 950 Lincoln, Palo Alto, Calif.

HUGOTON Embayment and Anadarko Basin Leases & Royalties, Western Oklahoma and Southwest Kansas Areas. John P. Mathis, P. O. Box 1106, Amarillo, Texas.

APPROXIMATELY 700 acres: Texas Panhandle near big showing well nearing completion; either sell lease or full title. Independent company can do well; exploring all done and paid for. John E. Welton, 239 S. Prospect Street, Bowling Green, Ohio, for full details.

GOOD Oil Prospects. Want Independent driller interested in Dundy County, Neb., Denver-Julesburg Basin, close to Colorado line. 1200 acres. Write R. C. Hartsough, 3425 Maple Ave., Berwyn, Illinois.

WYOMING-COLORADO HOT SPOT

Have structure proven for shallow production—Mapped by U.S.G.S. and Major Oil Co. Geologists—Adjacent leases held by largest Major Oil Companies. 3 locations made for deep tests—$250,000.00 oil loan wanted to drill proven lease. Pay top interest and share in property after repayment. S. M. James, 1320 East Drachman St., Tucson, Arizona, Phone 2-2464.

WE want a good drilling block, some production with proven or semiproven acreage to be drilled preferred, from owner principals. Must be good properties. Box E-460, The Oil and Gas Journal, Tulsa, Okla.

FOR SALE: Oil and Gas Leases adjoining producing leases, also wildcat leases, drilling propositions and small producing properties; all in shallow territory. W. P. Harley, Bowling Green, Ky.

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THREE Drive In Theaters, $350,000.00. Terms. Sound Investment. Will Stand very Closest investigation. Southwest Texas. Reason for Selling, old Roughneck retiring. Made his. Box E-468, The Oil and Gas Journal, Tulsa, Oklahoma.

WANT
N. Y. EXPORT REPRESENTATION?

Long established and well known oil well equipment manufacturer who has maintained N. Y. export office and sales personnel for many years, is now in a position to handle additional representation in New York for high quality manufacturers of oil equipment items. If you're looking for increased export business, write for further information. All replies held in strict confidence.

Box E-359, The Oil and Gas Journal, Tulsa, Oklahoma

Public-Land Sale Set

WASHINGTON.—First 1952 sale of public-land oil and gas leases will cover 400 acres in Wyoming and New Mexico, on which the U. S. Bureau of Land Management will open bids January 2.

The Wyoming land totals 319.69 acres, offered in three parcels of 160, 120, and 39.69 acres, respectively, in Grass Creek field 29 miles northwest of Thermopolis.

The New Mexico land is 80 acres to be offered in one parcel, in the Maljamar field 38 miles east of Artesia.

Leases will be awarded to the qualified bidders of the highest cash bonus on the usual rental and royalty terms.

Fields Used for Storage

CALGARY, Alta.—Canadian Western Natural Gas Co., of Calgary, has placed in operation an underground-storage project in the depleted Bow Island and Burdett gas fields.

Gas is returned at the rate of 6,500 M.c.f. daily through the old Canadian Western pipe line which once served Calgary from Bow Island field. Eleven storage wells are being employed currently.

Central Area

(Continued from page 116)

ed to be flowing 4 bbl. of oil an hour through a 5/64-in. choke from an Alpena Traverse pay after acid treatment with 750 gal. A 5 per cent water-cut was showing on first grindout tests, but operators were of the opinion that most, if not all, of this water was a slug of acidizing fluid showing up on first flow returns.

Traverse lime top (Squaw Bay) was logged at 2,980 ft. Alpena Traverse was logged at 2,993 ft. and oil pay was logged at 2,998-99 ft.

Hole carried 1,050 ft. of free oil natural, no water, in 15 hours and well swabbed oil natural at the rate of 1 bbl. an hour. During the first 12½ hours after the acid treatment, well flowed a total of 75 bbl. of net oil through various choke arrangements. Well was acidized at a maximum pressure of 500 psi. At the 4 bbl. flow rate, casing pressure was reported at 485 psi. and tubing pressure at 275 psi.

This wildcat also logged a 1,035,000 cu. ft Stray sand gas pay on drill-stem test. The 1 Adair is located approximately 2 miles to the northeast of the Paris Traverse oil pool in the same township, and pay at this new potential discovery appeared to be comparable with the Paris Traverse oil pay.

Bulk of acreage around this wildcat is owned by the operators listed on the drilling permit issued for the 1 Adair.

ILLINOIS SUCCESSFUL WILDCAT

Wayne County: George & Wrather and Sam Lewis 1 McGrew, NE NE SW 21-2n-6e, IP 251 bbl., Rosiclare 3,083-89 ft. and McClosky 3,137-40 ft., TD 3,204 ft. (new pool discovery).

ILLINOIS WILDCAT FAILURES

Clinton County: G. C. Schoonmaker 1 Wassem heirs, SE SE NW 7-3n-1w, dry, TD 2,935 ft.

Lawrence County: J. L. Crawford 1 Bennett, SE SW SE 33-3n-13w, dry, TD 2,687 ft.
W. R. Murphy 1 Pinkstaff heirs, SE SW SE 2-4n-11w, dry, TD 1,668 ft.

Madison County: J. W. Everhart 1 Kaufman, SW NW SW 2-5n-6w, dry, TD 1,876 ft.

Marion County: H. F. Robison 1 Hill, SW SE NE 28-4n-1e, dry, TD 1,466 ft.
H. V. Spires 1 Blankenship, NE NE SW 35-1n-4e, dry, TD 2,908 ft.

White County: Aubrey-Tennant 1 Creek NE NW SE 15-5s-10e, dry, TD 3,170 ft.

INDIANA SUCCESSFUL WILDCATS

Knox County: Cline & Lambert 1 Pea, Survey 41-2n-10w, IP 6 bbl., Aux Vases lime 1,711-16 ft., TD 1,827 ft. (extension and new pay Iona pool).

Warrick County: Tecumseh Coal Co. 1 Harold, SE NW SW 20-4s-7w, IP 8 bbl., Aux

"Him? He's one of the oldest scouts in the company."

Vases lime 1,526-32 ft., TD 1,534 ft. (discovery well Dickeyville pool).

INDIANA WILDCAT FAILURES

Posey County: Morris Drilling Co. 1 Grigsby, SE SE NE 36-3s-13w, dry, TD 2,108 ft.

Slagter Producing Co. 1 Weyerbacher, NE NW NE 26-8s-14w, dry, TD 2,863 ft.

Sullivan County: W. W. Dayton 1 Coulson, NE NW SW 11-7n-10w, dry, TD 882 ft.

Vigo County: Aubrey Tenant Oil Co. 1 Payne, NW NW SW 28-10n-8w, dry, TD 2,007 ft.

R. J. Coombs 1 Ring, C E½ NE NW 33-10n-9w, dry, TD 2,250 ft.

J. W. Steele 1 Hunt, SW SW NE 19-10n-10w, dry, TD 1,514 ft.

WESTERN KENTUCKY WILDCAT FAILURES

Henderson County: Pioneer Oil Co. 1 Cloffer, NEc NW NE NE 8-O-23, dry, TD 2,650 ft.

W. E. Styles 2 Sowards, SEc SE SW SW 7-P-21, dry, TD 2,379 ft.

McLean County: Stewart Coal & Oil Co. 1 McManama heirs, EL NW SW NW 22-L-28, dry, TD 2,111 ft.

Muhlenberg County: L. McIntosh 1 Lee, NEc SE SE NW 15-I-28, dry, TD 1,920 ft.

Union County: Sun Oil Co. 1 Houston, NEc NW NE SW 24-O-19, dry, TD 2,725 ft.

Webster County: Ashland Oil & Refining Co. and S. Yunker 1 Ramsey, S½ NW NE SE 6-L-23, dry, TD 3,339 ft.

MICHIGAN OIL FAILURES

Ottawa County, Jamestown Township: Ford Oil Co. 1 DeKleine, SE SW NW 30-5n-13w, Traverse 1,667 ft., dry, TD 1,671 ft.

Tuscola County, Novesta Township: Alvin H. Weber 1 Lenard, SW NW NE 26-13n-11e, Berea 1,595 ft., dry, TD 1,680 ft.

Permian Basin

(Continued from page 115)

SOUTHEAST NEW MEXICO SUCCESSFUL WILDCATS

Lea County: Fullerton Oil Co. 1 Elliott, 1-21s-37e, TD 8,370 ft., elev. 3,493 ft., McKee, 7,942 ft., pay 8,005 ft., IP 245 bbl., 43°-gravity oil, 8/64-in. choke, TP 590 psi., GOR 970:1.

Forest Oil Corp. 1 Lowe, 25-13s-37e, TD 13,145 ft., elev. 3,867 ft., Pennsylvanian pay 10,126 ft., IP 385 bbl. 38°-gravity oil, ½-in. choke, TP 180 psi., GOR 734 cu. ft.

Skelly Oil Co. 1-K Mexico, 29-24s-38e, TD 9,177 ft., elev. 3,219 ft., pay 6,616 ft., IP 145 bbl. 40°-gravity oil, 21/64-in. choke, TP 120 psi., GOR 1,243:1.

SOUTHEAST NEW MEXICO WILDCAT FAILURES

Eddy County: Carper Drilling Co. 1 Shugart, 22-20s-26e, dry, TD 2,725 ft., elev. 325 ft., San Andres 1,476 ft.

Lea County: Gulf Oil Co. 1-J Lea-State, 12-13s-27e, dry, TD 12,603 ft., elev. 3,881 ft., Wolfcamp 9,225 ft., Mississippian 11,860 ft., Devonian 12,570 ft.

Hudson & Hudson 1 Amerada State, 24-21s-34e, dry, TD 4,045 ft., elev. 3,754 ft., Seven Rivers 3,515 ft.

Los Nietos Oil Co 1 Elliott-Federal, 27-11s-38e, dry, TD 12,272 ft., elev. 3,901 ft., Pennsylvanian 11,066 ft., Mississippian 11,422 ft., Devonian 12,088 ft.

N. G. Penrose 1-A State, 17-20s-39e, dry, TD 4,435 ft., elev. 3,537 ft., San Andres 4,335 ft.

LEGAL

5,025.33 ACRES of Tribal and 80 ACRES of Allotted Indian lands located in Townships 2, 3 and 4 South, Ranges 8, 9 and 10 West, within the jurisdiction of the Uintah and Ouray Reservation, Utah, are being advertised for lease, bids on which will be opened January 18 at 2:00 P.M., at the office of Forrest R. Stone, Superintendent, Uintah and Ouray Agency, Fort Duchesne, Utah. Full particulars may be obtained from Mr. J. R. Schwabrow, U. S. Geological Survey, Casper, Wyoming, or from the Uintah and Ouray Agency.

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Canadian Fields

(Continued from page 112)

Warner group's Campbell wells. The gas came at 3,665-93 ft., at rates up to 2,724,000 cu. ft. daily. An indicated 13½ ft. of Cretaceous oil pay zone was encountered between 3,694 and 3,707½ ft., with oil recoveries during drill-stem tests in that section ranging from 585 ft. and 1,080 ft.

Coring and testing operations are being continued at the D2 Devonian oil discovery well in the South Calmar area of Leduc that is being drilled by British American Oil Co., Ltd. This test well is located ¼ mile south of the company's D3 Devonian oil discovery well which was drilled in September of this year, and about 2¼ miles south of previous D2 oil producers in the South Calmar area. British American's well, in LSD 3, 2-49-27w4, has so far opened up some 70 ft. of D2 Devonian water-free oil zone.

The wet gas discovery well in the Bonnie Glen area is located about 6½ miles south of D3 Devonian oil wells at Wizard Lake This venture has so far opened up 173 ft of D3 distillate-bearing coral reef. During drill-stem tests in D3 reef the well measured gas-distillate in excess of 5,500,000 cu ft. daily, but it is believed that the well is capable of putting out a volume greater than that. Hole is now bottomed at 6,557 ft and after carrying out a precautionary cement job, coring will be continued in search of a D3 oil column.

The Chancellor area discovery, located about 48 miles east of Calgary, has opened around 100 ft. of Sunburst sand section, a portion of which has flowed natural gas plus some naphtha. Gas flow rates were measured up to 5,500,000 cu. ft. daily, and well is now below 4,916 ft., believed to be either in or near its Madison limestone objective.

Other gas discoveries made during the 3-week period include: Imperial's Viking sand oil strike in the Hairy Hill area; the Canadian Delhi-Dome Exploration team's gas find in the Rocky Mountain quartzite at Sullivan Creek; the basal Cretaceous gas discovery made by the Great Plains-Reef-Tower group in the Wavy Lake area; and the Viking sand gas discovery made by Bay Petroleum Corp. and West Canadian Petroleums in the Hanna area.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR. Bureau of Land Management, Washington 25, D. C. Notice is hereby given that one parcel of land containing approximately 233.74 acres in T. 5 N., R. 91 W., 6th P.M., within the known geologic structure of the Moffat field, Colorado, will be offered for oil and gas leasing through competitive bidding at 1 p. m., Eastern Standard Time, on February 13, 1952, when bids will be opened. Details of the lease offering, how and where to file bids and a description of the lands may be obtained by addressing an inquiry to the Manager, Land and Survey Office, Denver, Colorado, or to this office. Marion Clawson, Director.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR. Bureau of Land Management, Washington 25, D.C. Notice is hereby given that four tracts of land totaling approximately 680.98 acres, in Ts. 6 and 7 S., Rs. 21 and 22 E., P.M., Montana, within the known geologic structure of the Dry Creek field, will be offered for oil and gas leasing, through competitive bidding to the qualified bidders of the highest cash amounts per acre, at 1 p. m., Eastern Standard Time, January 30, 1952, when bids will be opened. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Land and Survey Office at Billings, Montana, or to this office. Marion Clawson, Director.

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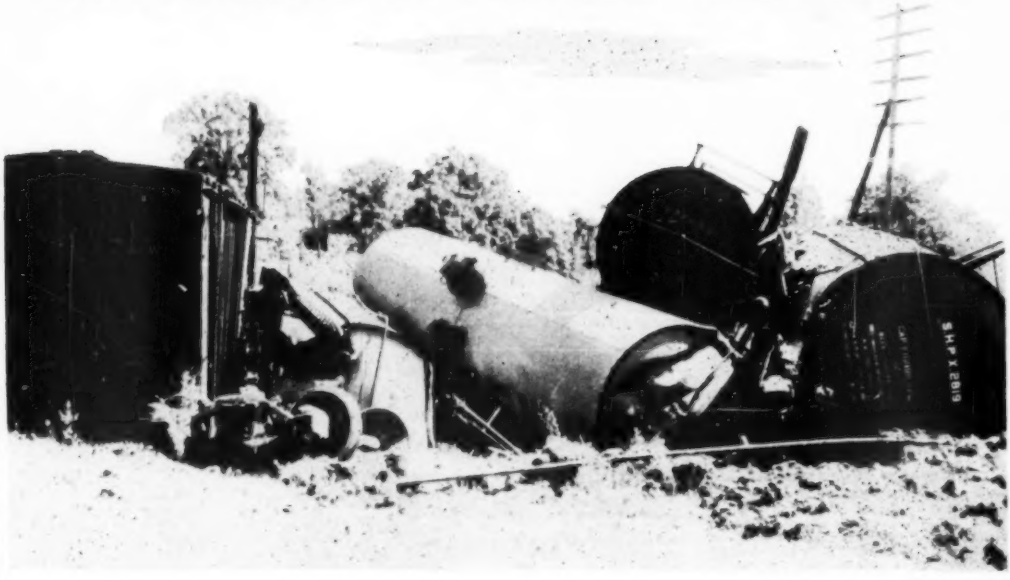
NOT A DROP OF LADING WAS LOST!



Here's an astonishing example of the tremendous built-in strength of A.C.F.'s assembly-line produced tank cars. Actually, these sturdy, all-welded tank cars are setting new records every day for low operating cost . . . and super safety on the rails.

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NO . . . not the only reason . . . but it's one big reason why Warren Petroleum Corporation has ordered over 2500 A.C.F. tank cars since they first started doing business with A.C.F. back in 1929! For when a tank car can come through a wreck like this one without a drop of lading lost, then it stands to reason that the car must be built to last! A.C.F. built all-welded tank cars are so spectacularly rugged, so inexpensive to maintain, that they save you many dollars as they pile up trouble-free mile after mile. No matter what you have to move, it's smart to get the complete story on safe, sure, assembly-line produced A.C.F. tank cars first. For information, write: American Car and Foundry Company, 30 Church Street, New York, N. Y. Other sales offices: Chicago • St. Louis • Cleveland • Washington • Philadelphia • San Francisco

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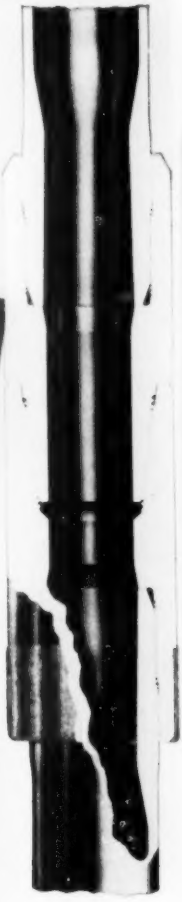

(Above and right) Orval Bridge and his crew coming out of the hole near Hays, Kansas. This is one of the Murfin Rigs equipped 100% with **REED** Super Shrink-Grip Tool Joints.

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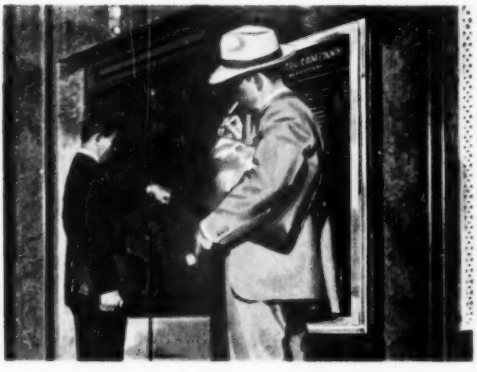
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